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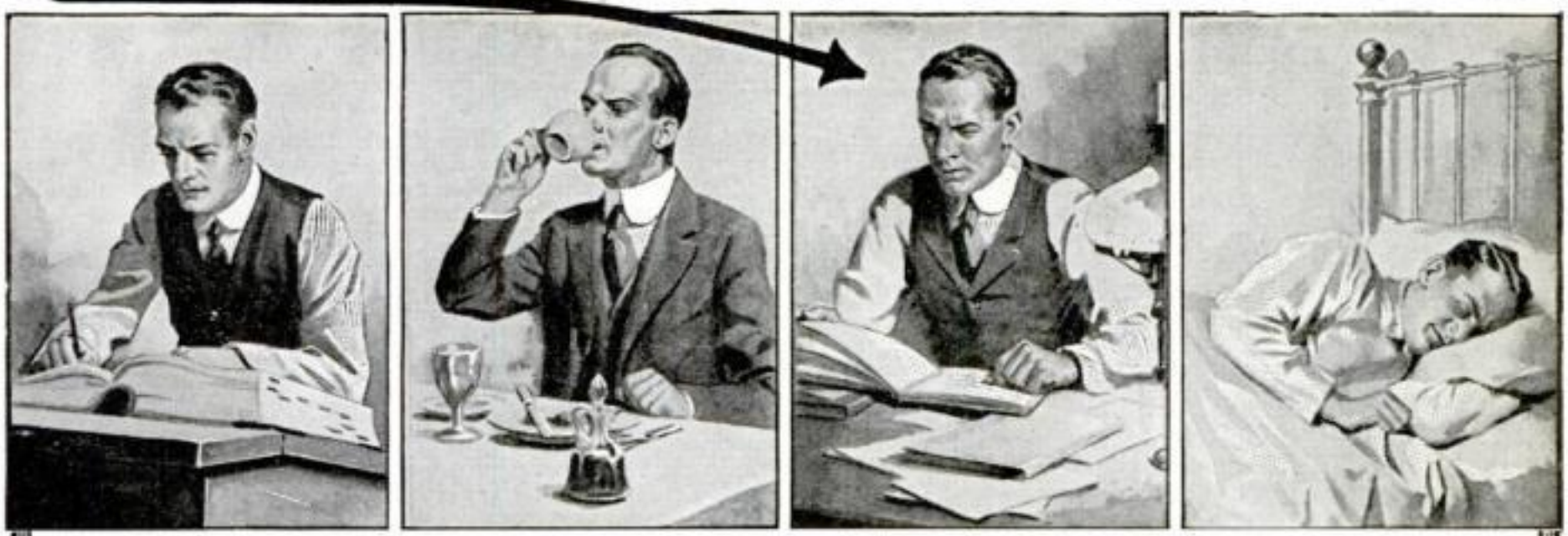

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The War, Electricity—and YOU

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President Wilson, in his Proclamation of May 17th, uttered the following significant words:

"The Nation needs each man in the endeavor that will best serve the common good. The Nation is being served only when the sharpshooter marches, and the machinist remains at his levers."

These sentences can have only one meaning to you men who want to find success through electricity. This country is in a world war, a struggle in which victory will come to that nation which is best equipped in the fullest sense—in arms, in men, and in science. You already know the large part that Electricity has played in the war; and that part is going to be greater as the war progresses and the genius of our Edisons and our Steinmetzes is brought into full play. In the vast preparations now under way in this country the opportunity lies open to all electrical men who are wide-awake enough first of all to perceive it and then to grasp it.

Serving the Nation Best This is your opportunity to serve your country in the manner for which you are best fitted; to take part in the great electrical work now going on. But the Nation needs no dabblers, no half prepared amateurs, who are mere wishers instead of workers. It needs only those who are prepared, who have learned electricity **by doing** the very work they are later called on to do. That is the kind of training you get in the New York Electrical School. The School that Trains while it Teaches. This is the method which enables you to cut out long years of apprenticeship and start as an expert in electricity.

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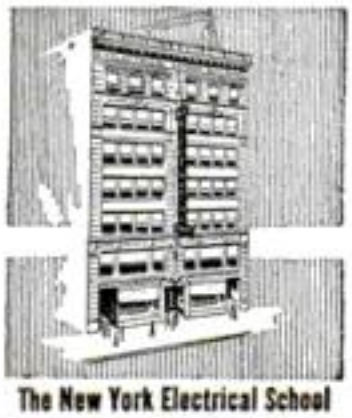

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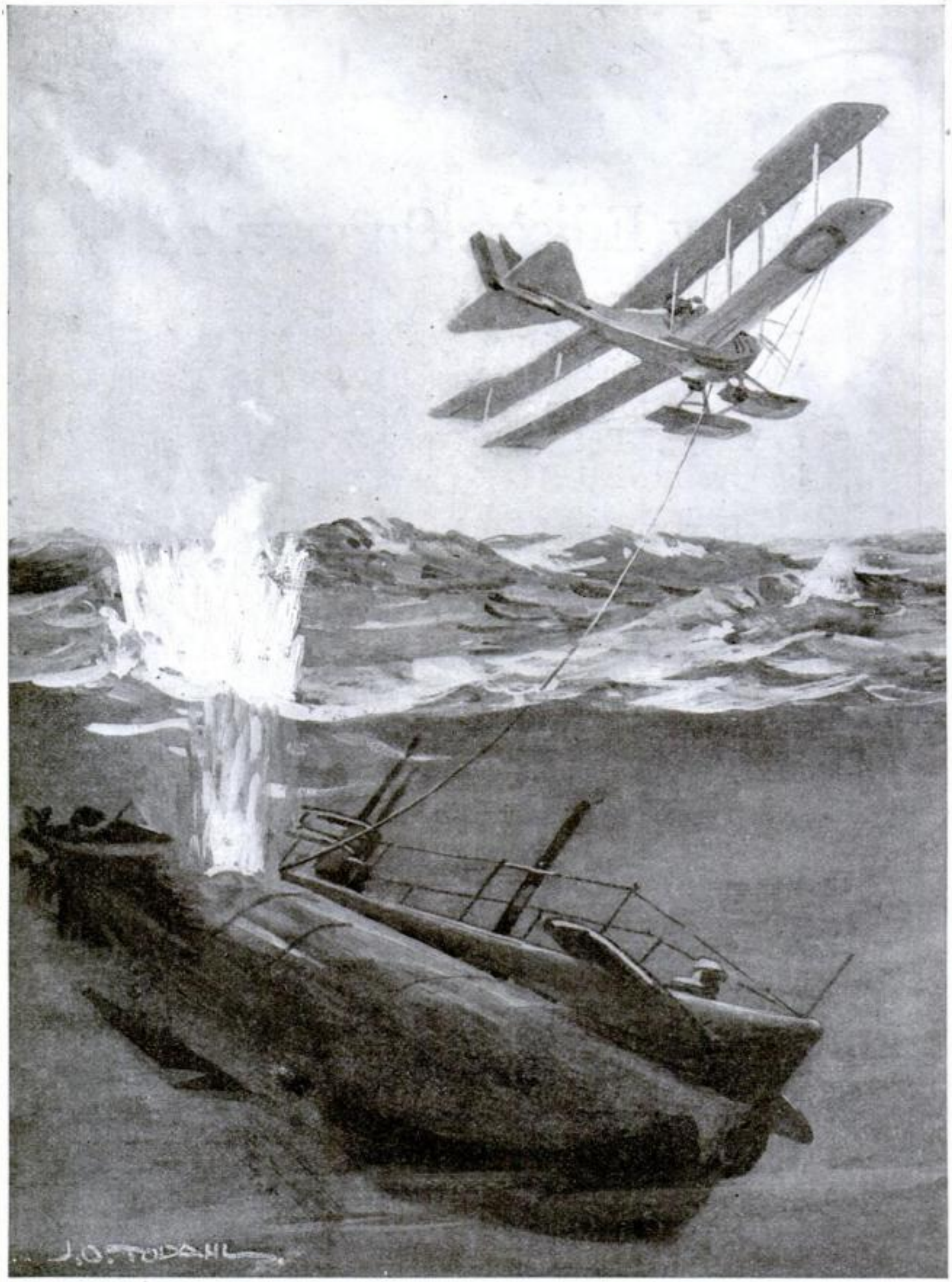
Destroying a Submarine with a Cable-Bomb



The air pilot lets the bomb sink until it is just below what he gages the depth of the submarine to be. When the airplane passes over the submarine, dragging the bomb on its wire, the airman gives the bomb a sharp pull upward. It strikes the hull of the submarine and explodes

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Drag-Bombing Submarines from Airplanes

A new method of airplane attack

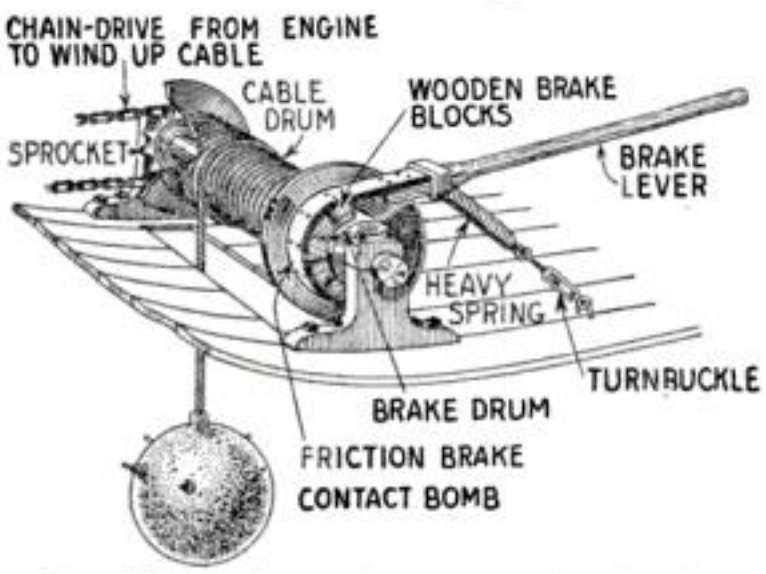
IN the airplane the elusive submarine has a deadly enemy. Flying high above the surface of the ocean, an airplane can see a submarine which has dived to avoid surface boats. The airplane's methods of attack have not been so unerring as the gun fire from the boats. But now comes Thomas E. Lake, the son of the distinguished inventor of the Lake-type submarine, with a new method of airplane attack which looks as though the clearing of waters infested by submarines will be accomplished with far more ease in the future than it has been in the past.

Instead of using high speed airplanes to drop time-bombs on the submarines, Lake has devised a slower speed airplane for dragging contact bombs against it. His airplane, which uses a distributed wind-lifting area, is capable of high speed when scouting for submarines. But when it sights one, this airplane can slow up and can carefully go through its manuevers without losing buoyancy. The present-day naval airplane cannot do that; so that this marks the first advantage in the Lake method of attack.

The next, and even more important advantage of the Lake attack is the manner of bombing. The submarine has little chance of escaping it. The slow-going airplane nears the submarine broadside on. A heavy contact bomb is quickly lowered to the proper depth in the water by a spring-controlled mechanism.

This mechanism is an entirely new device which received its inception with the development of this plan of attack. It is very sensitive, for at the slightest reduction in the tension of the spring, the bomb responds by sinking. It will continue to sink until the added upward thrust on the cable, caused by the water's pushing against the slanting wire which has just sunk beneath the sea, makes up the tension which has been lost from the spring. Therefore it is highly important to properly tighten this spring. In practice, this would be done by means of a turnbuckle which has been rigorously calibrated by factory tests.

The air pilot lets the bomb sink until it is just below what he gages the submarine's depth to be. The bomb thus drags along while the airplane approaches its prey nearer and nearer. Soon the airplane passes over the submarine. The wire dragging behind hits before long against the submarine hull. The bomb continues on and swings toward the hull, the airplane drags it the short distance upward, and the bomb strikes the submarine. The percussion explodes the mine, and blows up the submarine without its having the least chance to endanger the airplane. Even should the bomb miss the submarine, it could be exploded from the airplane. The operator simply releases the brake for an instant, then presses down hard on the brake lever. The jerk will fire the emergency device within the bomb, and if the submarine is anywhere near it, the resulting explosion will disable the submarine, at the least. The ordinary method of dropping time-fused bombs on a submarine requires nothing short of extraordinary skill in aiming and timing the bomb so that its explosion will be effective. That method cannot be one-tenth as effective as this drag-bombing plan.



Details of the spring-controlled brake which keeps the cable taut and enables the bomb to sink to the proper depth

© Brown and Dawson

Three exposures of the Arctic sun made on the same plate. The sun is shown rising, at noonday and at sunset. It travels along the very edge of the horizon, as if just peeping above it

How the Sun Looks in the Arctic Circles in the Morning, at Noon and at Night

NORTH of the Arctic Circle, during certain periods of the year, the sun barely peeps over the horizon. Some days you have to stand on your tip-toes, so to speak, to see it at all. At sunrise, midday, and sunset it appears just above the horizon, and remains in about the same position. It never climbs high into the heavens as it does in warm countries. It travels around the horizon.

The illustration shows three exposures of the Arctic sun made on the same plate. The photograph was taken December 1, 1915, at 11:45 A. M., 12 M. and 12:15 P. M., respectively. Nine days after the photograph was taken the sun did not appear above the horizon at all, but remained below for five weeks, gradually appearing again in reverse order.

"An Army Travels on Its Belly," Said Napoleon—Also on Its Feet, Say Chiropodists

IF your feet trouble you, you are only about fifty per cent efficient as a fighting man. In the Fourteenth Regiment of the National Guard, in Brooklyn, N. Y., the men must submit themselves to a foot examination. The accompanying illustration shows a number of them undergoing treatment at the hands of the 1917 class of the School of Chiropody of New York. The young graduates volunteered their services long before hostilities were declared.

Graduates of a school of chiropody applying themselves to the relief of the foot troubles of a Brooklyn regiment

Regular established undergraduate and postgraduate medical schools pay but little attention to foot conditions unless they require major surgical treatment. Consequently there is a particular need for chiropodists at the present time. Numbers of them will doubtless be engaged for the army.

A Mechanical Hair-Parter. It Places Every Hair Where It Belongs

LOOK at this hair-parting apparatus. It accurately outlines a straight part on any portion of the scalp, separating the hair easily and quickly without dependence upon a mirror.

The device consists of two flat strips of celluloid or vulcanized rubber which may be bent lengthwise to conform with the shape of the head. These are pivoted together, edge to edge, in such a way that either strip may be swung around independently of the other. The strips are laid with their confronting edges along the line where the part is to be made. One is held down to conform with the shape of the head and the other is swung around carrying the free hair with it. Thus the hair is parted.

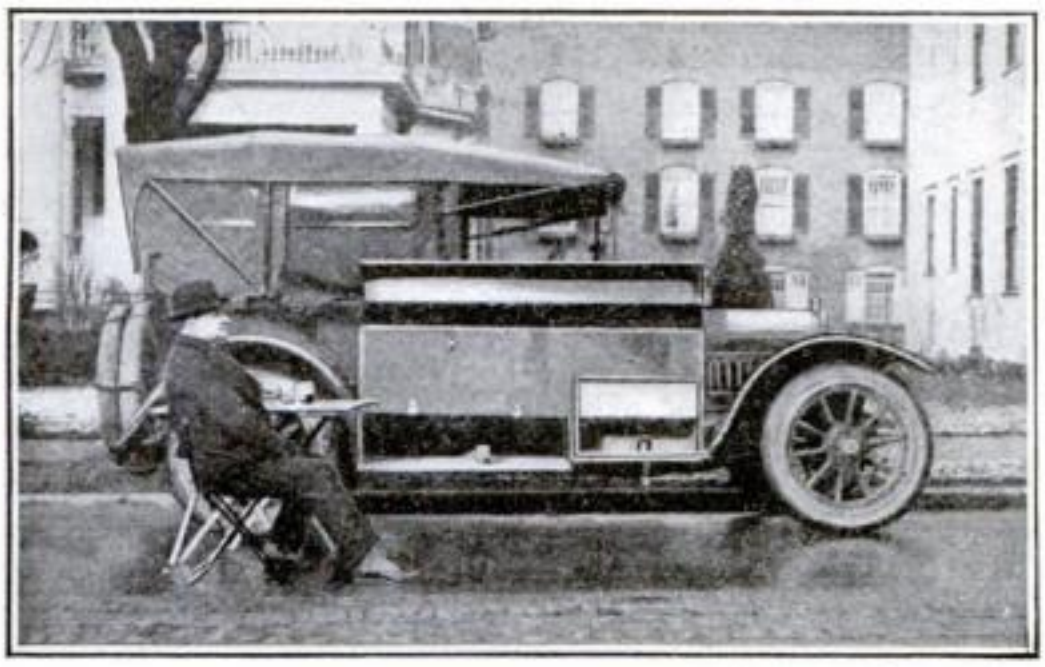
One strip holds the hair down on an imaginary line, while the other sweeps the free hair to one side, making a straight part

A Combined Ice-Box, Pantry and Trunk for Automobiles

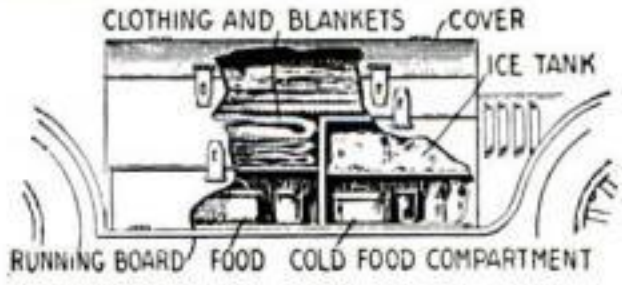
A COMBINATION refrigerator, pantry and trunk, which can be made to fit any automobile, has been invented by Ralph S. Hopkins of Seattle. Hopkins has found this contrivance, made of iron for his five-passenger car, most valuable for automobile trips.

The apparatus weighs sixty pounds and is placed on the running board. It takes up the entire space on one side between the front and rear fenders, without detracting noticeably from the car's appearance. It is fastened in place with four bolts. It is as high as the top of the doors of the motor car. The whole apparatus is made of sheet iron, painted to match the car, with the exception of the refrigerator, which is of galvanized iron to prevent it from rusting.

Hopkins uses his refrigerator, located at the lower right corner of the picture, for ice and perishables. The refrigerator is divided into two sections, the upper which holds the ice, and the lower which carries milk, butter and the like. In the lower compartment on the left side groceries are kept, while in the top section, which extends the whole length of the apparatus, are stored all other necessary articles for long trips, such as clothing, fishing tackle, guns, folding chairs and tables.

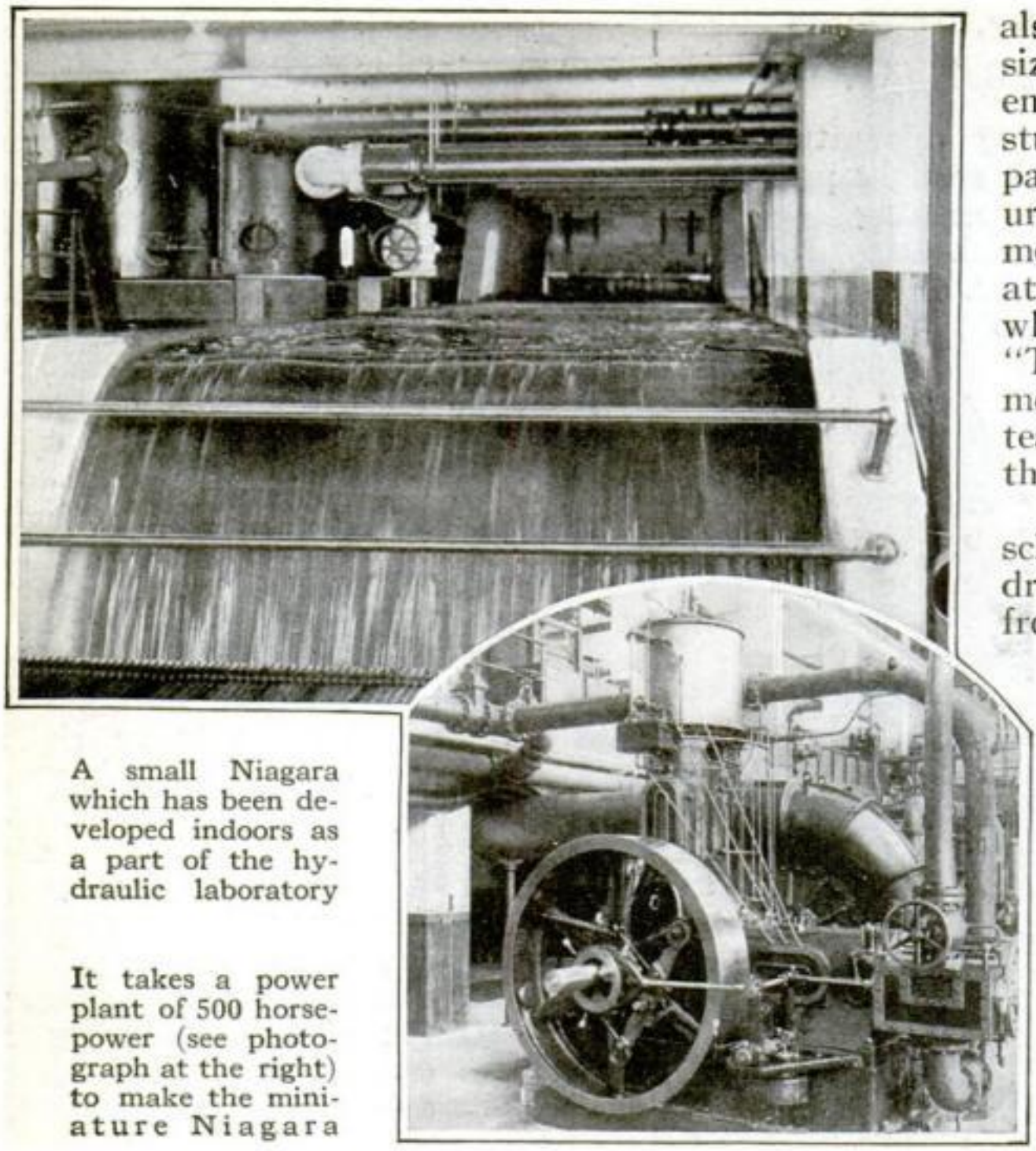


The owner of this automobile can stop at any suitable spot, set his table and partake of a comfortable meal from the refrigerator on the running-board of the automobile



There Are Five Hundred Indian Languages in the United States

BEFORE you write the Government or the Smithsonian Institution and request it to send you the Indian name for this or that thing, bear in mind that there is no one American Indian language. On the contrary, there are no less than one thousand languages in the two Americas and practically five hundred distinct Indian languages north of Mexico. Thus, it is impossible to give the Indian word for any English equivalent. If you do receive an answer to your inquiry, the word given is probably chosen from the language of the tribe which once inhabited the particular part of the country from which the request comes.



A small Niagara which has been developed indoors as a part of the hydraulic laboratory

It takes a power plant of 500 horsepower (see photograph at the right) to make the miniature Niagara

also commercial forms and sizes of turbines under large energies of water may be studied. The whole apparatus is fitted with measuring devices so that precise measurements may be made at any point. One engineer who inspected the outfit said, "This is using a river and measuring its effects with a teaspoon," so delicate are the tests applied.

In the basement of the school there are eight hundred feet of canals supplied from the Charles River Basin. These have turns and narrowings and junctions, so that the flow may be observed under all possible conditions. The outfit includes many pumps and engines for the work, aggregating about 500 horsepower, together with compression tanks and all the essentials for a mammoth indoor hydraulic laboratory.

The Largest Indoor Waterfall in the World

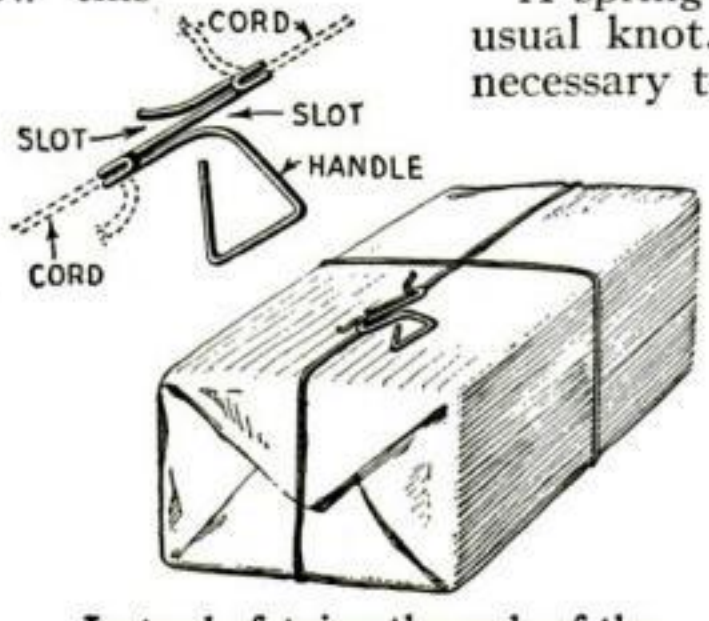
THIS waterfall is not out of doors, nor is it used for the development of power, but it represents the flowing of one hundred tons of water each minute and energy of more than three hundred horsepower. It is part of the laboratory equipment at the Massachusetts Institute of Technology, and illustrates how this school teaches by means of commercial quantities under ordinary conditions.

The water here shown has been lifted to an elevated canal, which the students call "the big brook," forty feet above the base of the pump, and returns through a great penstock ten feet in diameter to the outflow canal. The conduct of water under such pressure and

It Fastens Cord Tighter Than You Can Tie It

A PACKAGE tie designed to fasten cord without tying the ends, has been invented by Warren L. Bald, of New York city. The inventor claims that his tie will fasten a cord tighter than any knot ever devised and will hold the cord more securely than a number of knots.

A spring wire takes the place of the usual knot. Only two operations are necessary to tie the cord. The cord is hooked around the wire loops, and, when a strain is put on these loops, the cord is pulled tighter, the spreading of the wire acting as a lever. The device not only saves the fingers of the person who wraps a large number of packages daily, but with the cord properly secured in the wire loops it is impossible for the packages to fall apart.



Instead of tying the ends of the cord you simply fasten them in the wire loops. The wire takes the place of the usual knot

Foiling the Pickpocket and Protecting Your Watch

A VERY simple device to prevent your watch from falling out of your pocket has been invented by Carl Anton Nord of New York City. It consists of a case stamped from sheet metal and lined with soft fabric. The case, which is fastened securely to the pocket, has a notch at the top, which is rounded to admit the stem of the watch. The stem of the watch is pushed down inside of two prongs which project slightly above the case.

These prongs require some effort to separate them, so that the watch can not fall out or be easily pulled out by a pickpocket, without the owner being immediately aware of it.

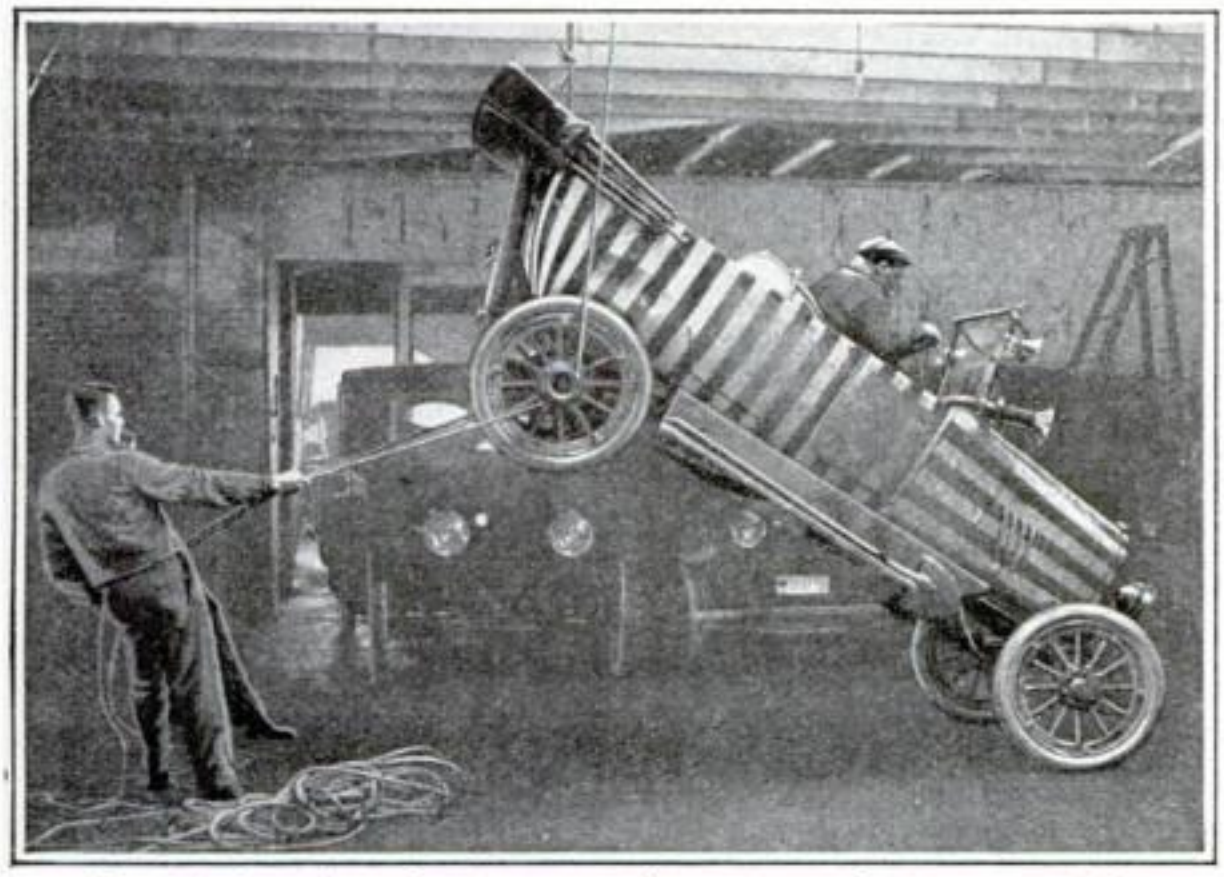
The watch is held securely in a case which is fastened inside the pocket

Testing a Car's Power to Pull Itself Out When Stuck

GETTING stuck in mud, soft sand or snow—the particular circumstances depending on the season of the year—is one of the vicissitudes to be guarded against in southern California when motoring off the main highways in the mountains or deserts, as it is sometimes necessary to do there as well as in other sections of the country.

To demonstrate the possibilities of an invention to be used when the car is mired, a Los Angeles automobile dealer carried out the test shown in the illustration below. The rear end of a car weighing 2,250 pounds and equipped with a 24-horsepower engine was lifted high above the floor by means of ropes attached to the floor beams above and passed around hub drums fixed to the rear wheels.

In actual practice the ropes will be led forward to heavy stakes or other objects strong enough to resist the pull.



Test designed to demonstrate the power of an automobile to pull itself out of mud, soft sand or snow by means of power from its engine and ropes wound around hub drums

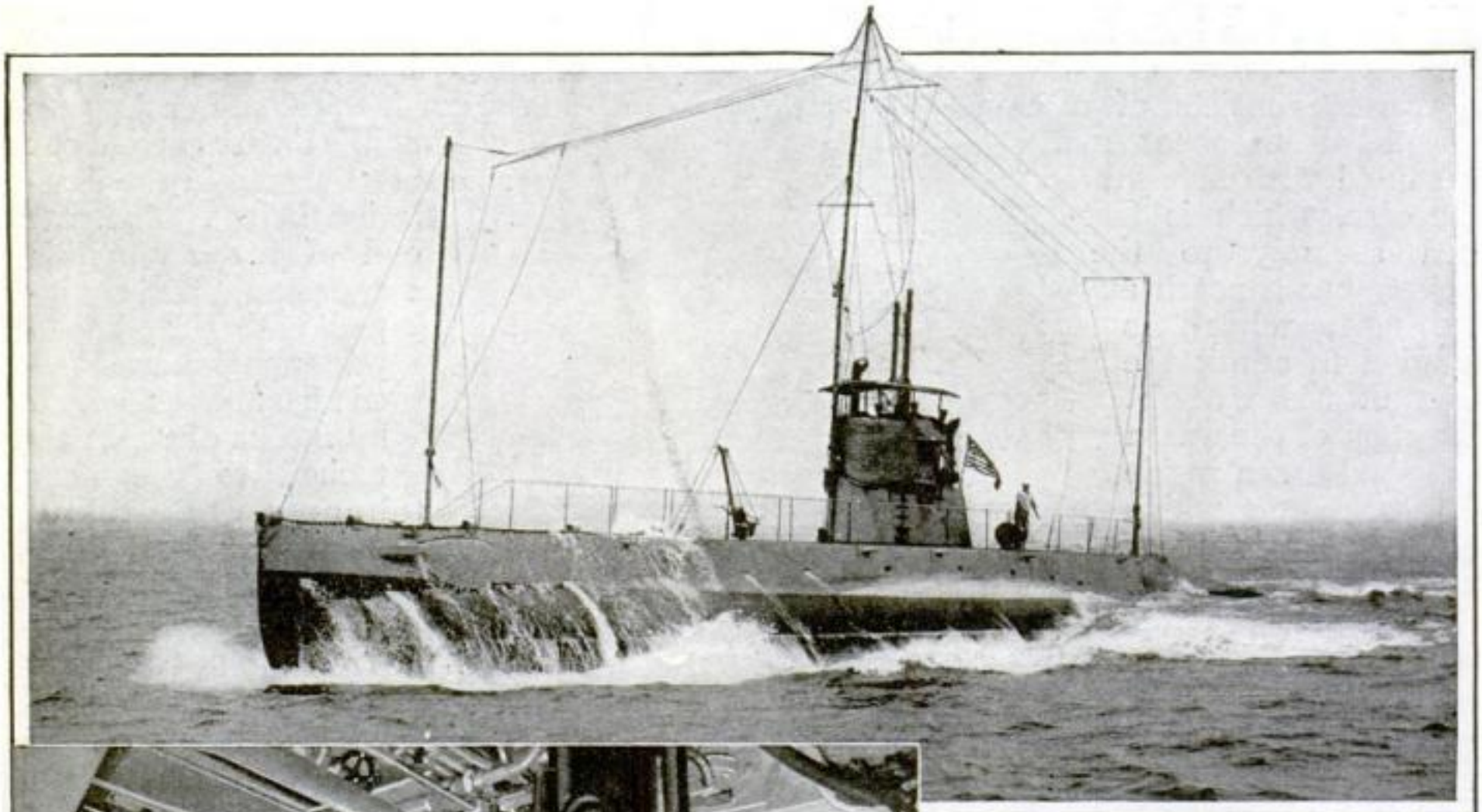
Take Good Care of the Eggs This Year—You Will Need Them

THE United States Department of Agriculture has called attention to the fact that carelessness in handling eggs causes an annual loss of over thirteen millions of them. The loss is due to small cracks in the shells. Once an egg shell is cracked even so slightly that the eye cannot detect it, the delicate, protective, gelatinous coating which Nature provides as a lining for it becomes exposed to the attack of germs and mold forms, lessening the keeping quality of the egg.

Five per cent of all cold storage eggs, the specialists find, spoil because of these small, scarcely perceptible cracks. Just a little more care in handling the eggs on the farm and in their transit to market and to the consumer will greatly lessen this important wastage.

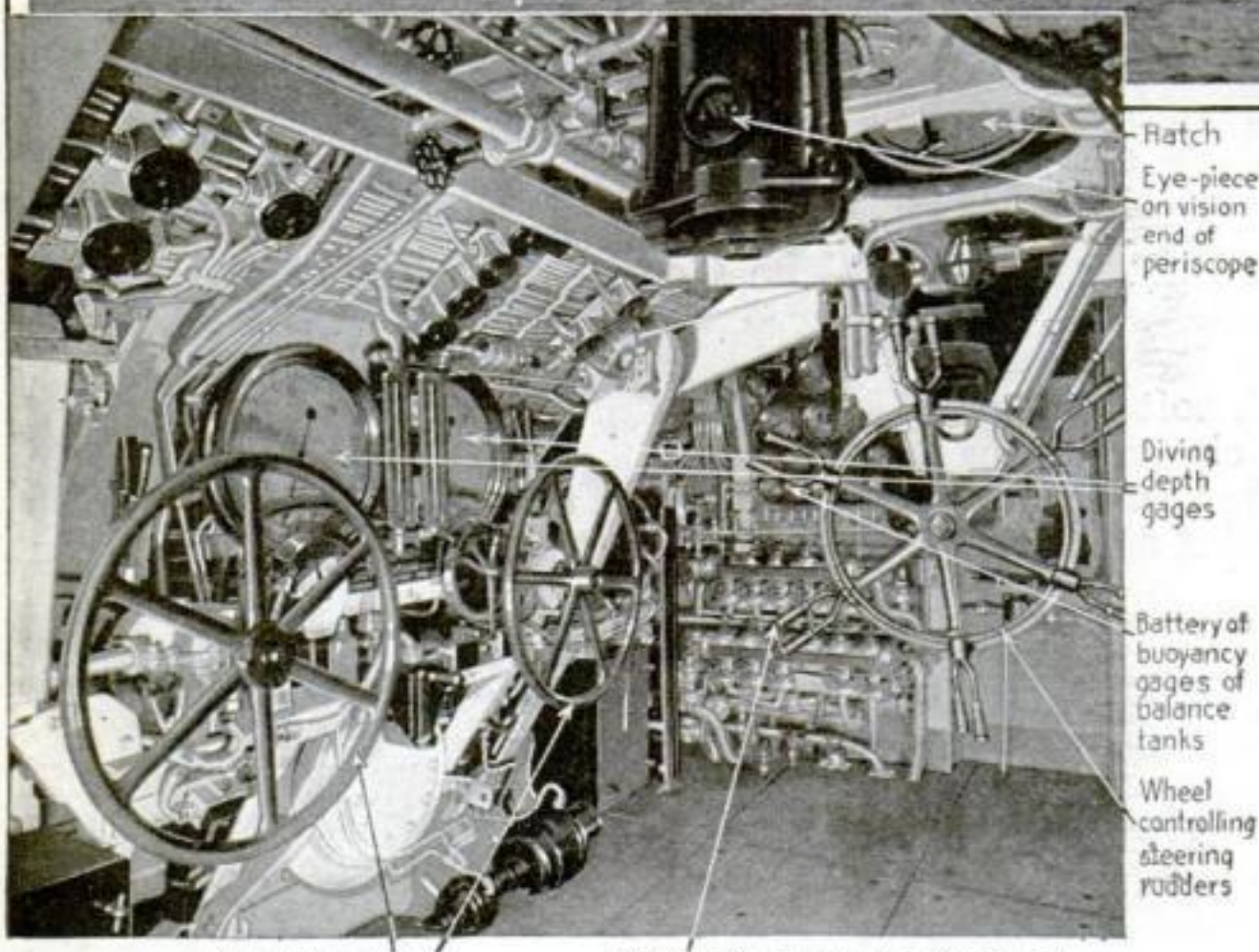
Handling a Submarine

The success of an attack and the very lives of the crew depend almost entirely upon their ability to act as one man



Photos © Press Illus. Serv.

Above: The U. S. S. "*K-1.*" Compressed air has just forced out the water from her huge ballast tanks so that she rides awash on the surface



At left: Interior of the "*K-1.*" During an attack, the commander stands at the periscope and directs the men at the wheels of the controls

EVERY submarine has its commander—generally a captain—who acts as the very brains of the ship. No one else can give orders; for so interconnected are all the machines, that the conflicting commands from more than one officer would almost surely result in an accident. Hence every one reports directly to the captain through the second officer in command, who, by the way, is also responsible for the correct operation of everything from the ballast tanks to the torpedoes.

In making the attack, the captain mans the periscope in the main operating room, just beneath the conning tower. The lenses and prisms in the periscope tube transmit the images from the sighting-piece above the water down to the periscope eye-piece.

When the vessel dives, the decks are first cleared. Then the hatches are sealed down and the oil engines are stopped, in

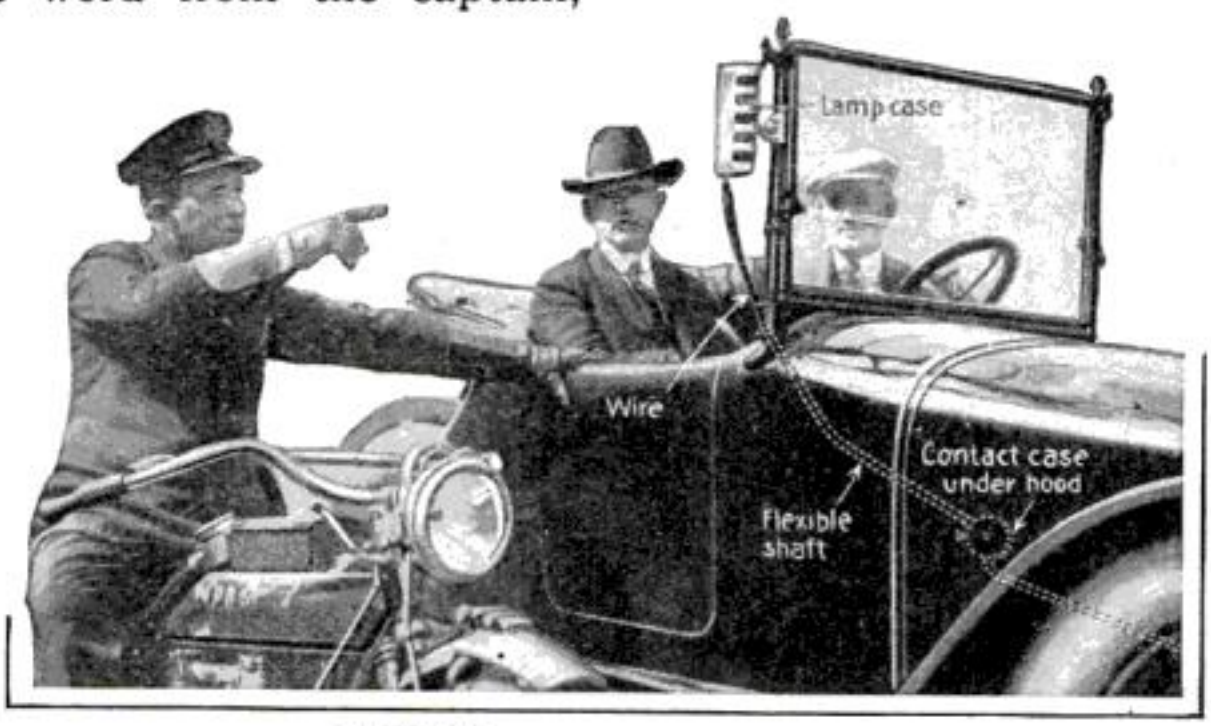
quick succession. Storage batteries are turned on to drive the electric propelling motors. Electric machinery must be used under water because the oil engines consume precious air and exhaust poisonous gases.

On the next word from the captain, water from outside is allowed to fill the huge ballast tanks in the central hull. Other ballast tanks at the ends of the boat are partially filled to hold the ship on an even keel. This trimming of the submarine, of course, can be delicately controlled by the buoyancy gages and controls in the operating room. The weight of all this water causes the submarine to sink, but not completely. The horizontal rudders at the stern of the ship are used to give the final touches to the dive. The commander directs the man at the wheel how far down he wishes to go. By watching the depth gages in front of him, the wheelman can so tip the diving rudders that the proper depth can be found immediately and held exactly.

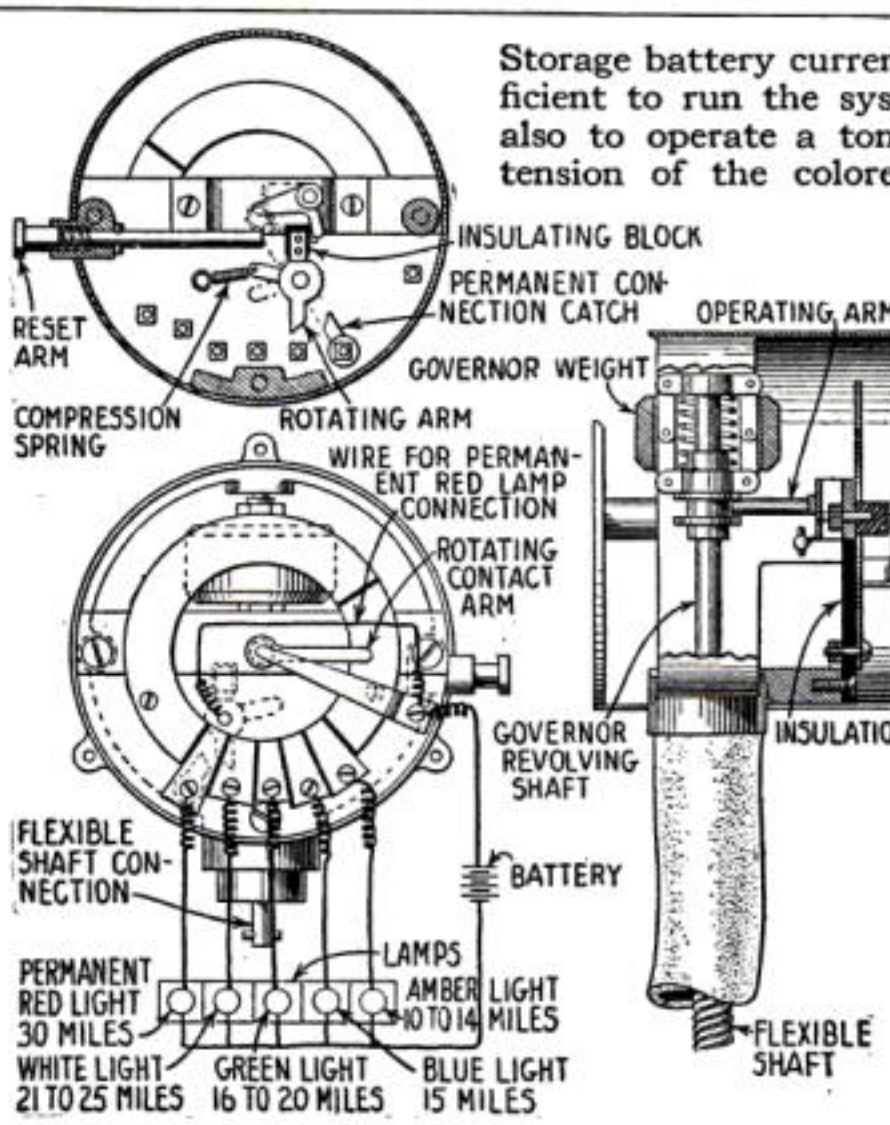
It takes but a minute or two to dive. In torpedoing a ship, the entire vessel must be turned to aim the torpedo tubes, which lie parallel with the central axis of the submarine, in the bow. The command is given to fire. The gunners in the forward compartment receive the order through speaking tubes or telephones. The torpedo is discharged from its tube by compressed air.

A Tell-Tale Light System—First Assistant to the Motorcycle Cop

IT would profit the French General Staff as much to have one of its members an agent of the German Intelligence Bureau as it would profit a motorist, bent on speeding, to display this tell-tale electric signal on the front of his machine.



Storage battery current is sufficient to run the system and also to operate a tonneau extension of the colored lights



Details of the mechanism by which the passengers and traffic policemen can be kept informed as to the speed of the car

The device consists of a series of colored lights, five in number, arranged perpendicularly in a metal case, and mechanism essentially similar to that of a speedometer.

When the automobile to which this signal is affixed moves at a rate of less than ten miles an hour, no light shows. From ten to fifteen miles an hour is indicated by an amber lamp. At fifteen the next higher lamp in the tier—a blue one—flashes on. At twenty comes a green light, at twenty-five a clear white light, and at thirty miles an hour or more a red signal shows.

Never more than one lamp is lit at any given time, except in the case of a car which has exceeded thirty-five miles an hour. At this point the red light short-circuits, and stays burning even though the car slackens speed or stops. If a car, therefore, shows a red light and a green light at the same time, it means that the car *has been* going at a rate higher than thirty-five miles an hour, and *is* traveling at about twenty.

Bayonet Practice for Our Recruits

Above: Marines practicing with the bayonet, which is the most effective weapon in this war, except the machine gun

At left: Marines dressed for bayonet practice. They wear masks, chest and neck protectors, and padded gloves

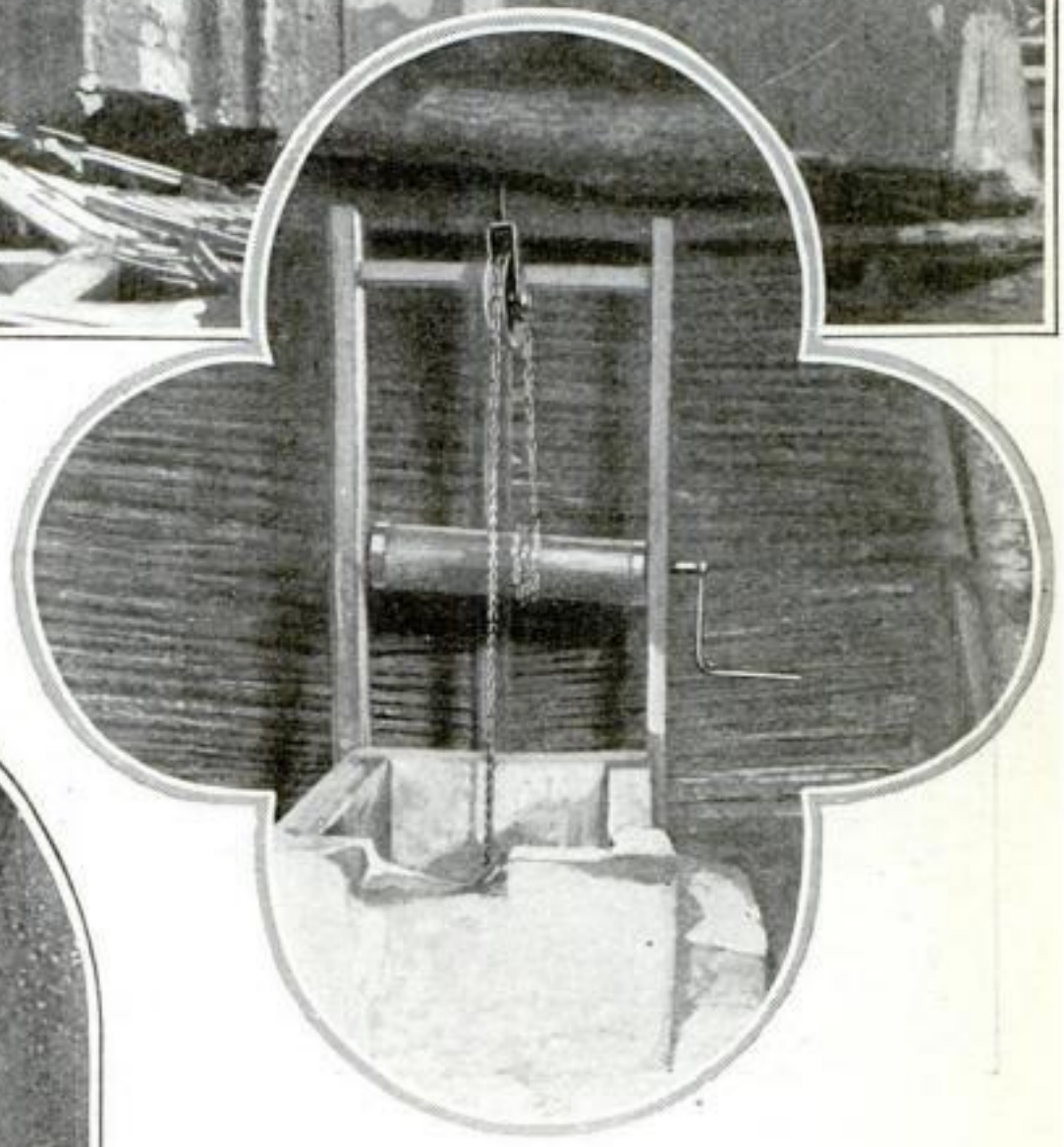
Photos © Kadel & Herbert

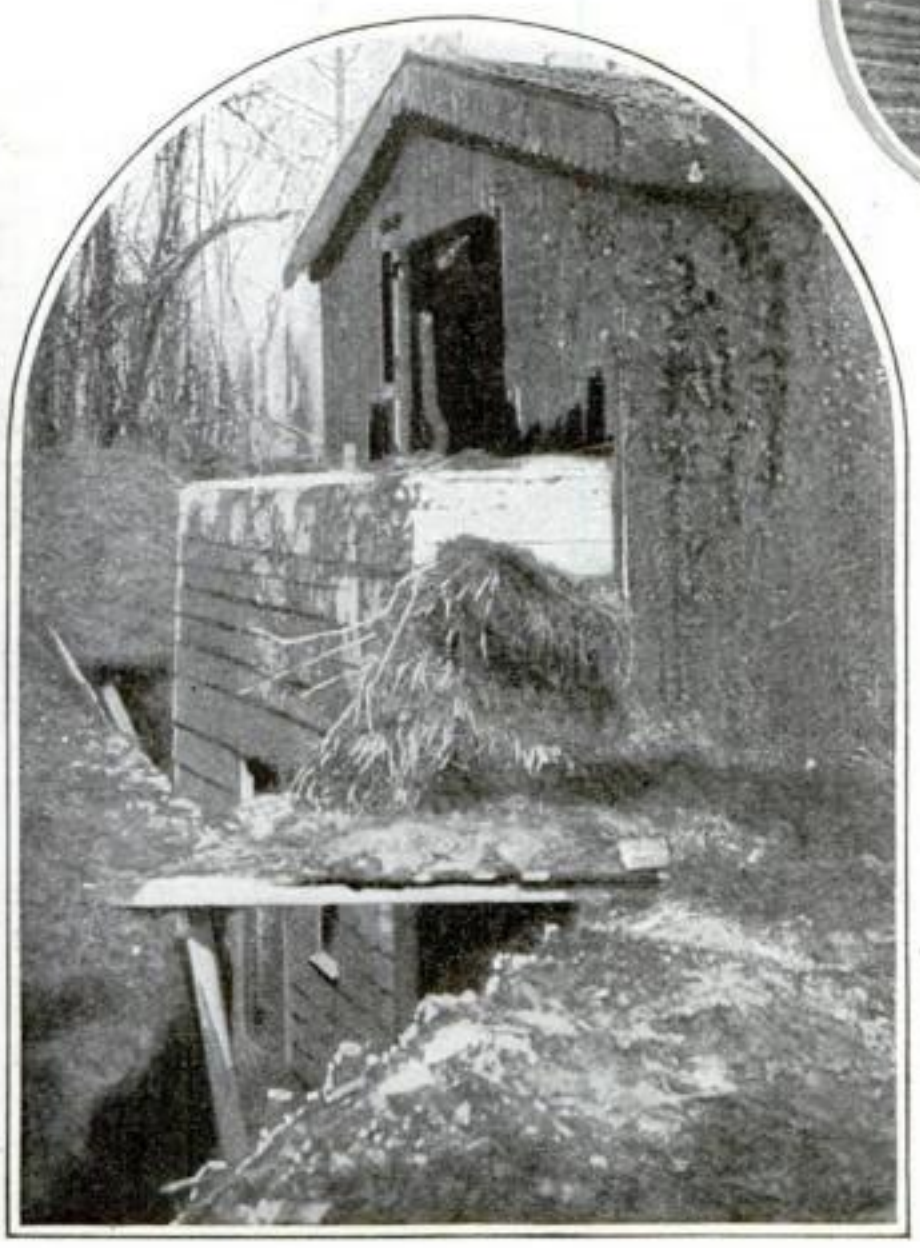
Photo Central News

Two methods of attacking an opponent are shown at left above. The figure is of stuffed straw, held rigidly in position by an iron rod. At right above is a dummy likeness of von Tirpitz. It served as a target at Plattsburg. The British manual of bayonet tactics has been adopted

Why the Hindenburg Line Seemed So Impregnable

French Official Photos



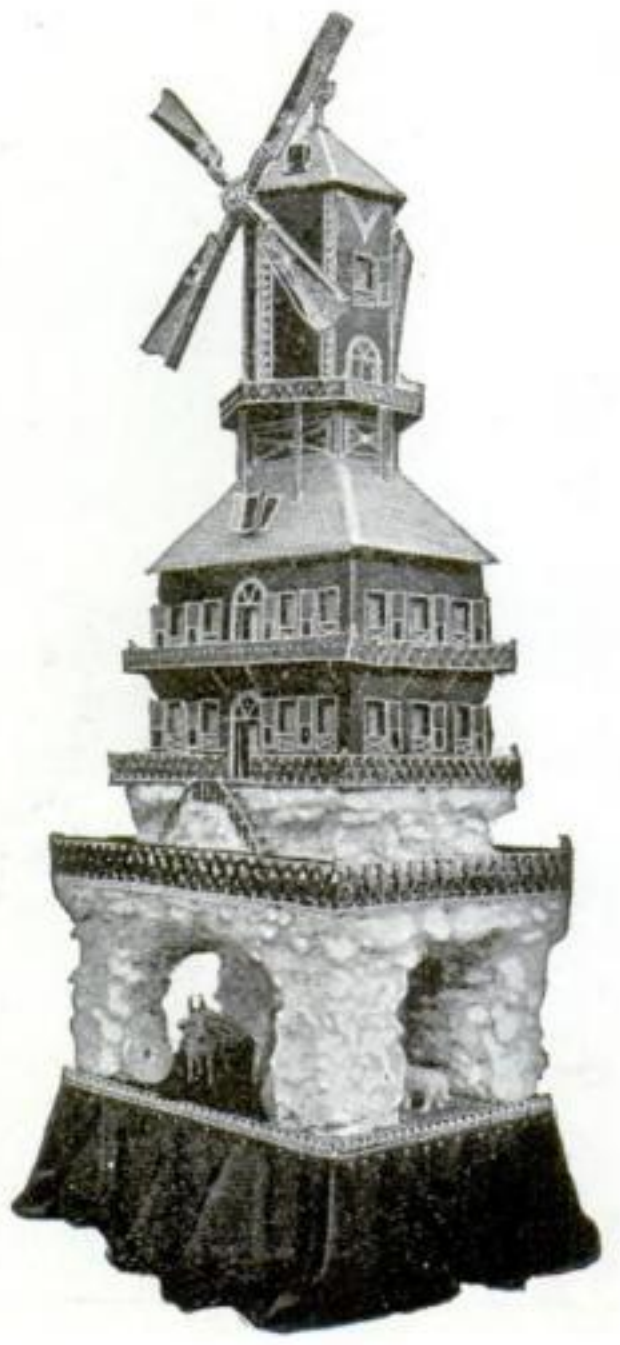


The victorious British have unearthed the secret of the strength of the Hindenburg line. It lay in concealed forts of solid cement hidden in the most ingenious ways. In the top picture one is seen built so as to seem part of a ruin

One fort discovered by the British was built under an old barn. It was covered over with grass and was entered by means of the ladder and pulley arrangement shown above. It was used as a station for a machine gun

The Michelangelos in Bakers' and Confectioners'

Above: Making wax flowers is now a full-fledged industry but flowers made from confectioners' sugar are equally artistic and true to Nature

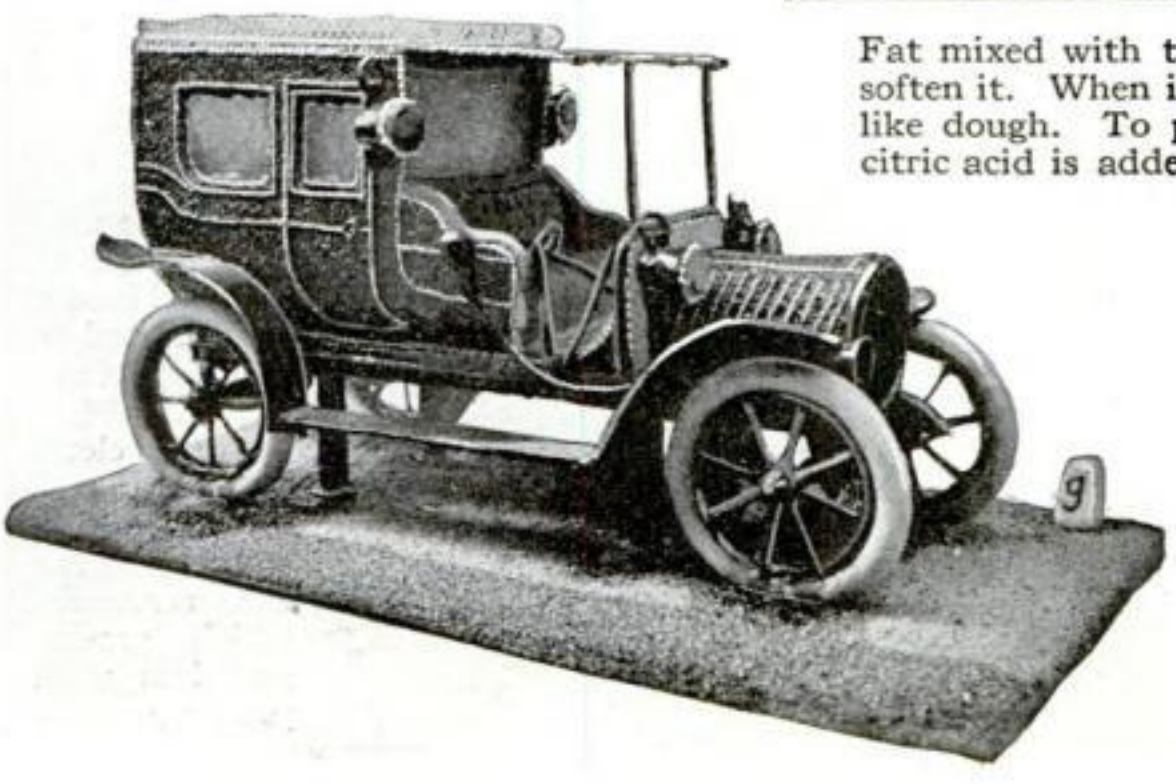


During the holiday season Paris shops contain an elaborate assortment of beautiful figures made of fat and sugar. Here a workman is shown pouring a fat and sugar mixture into a mold. There are a number of skillful artists in Paris who do nothing else in times of peace, but make these figures

A windmill palace made of chocolate and butter, a combination which is as effective for sculptural purposes as clay. Locomotives, steamships, airplanes, and about every type of building have been represented in chocolate and butter. They often contain equally edible figures of men and animals

Shops Do Their Work in Sugar, Chocolate and Fat

Above: An artist smoothing out the imperfections in a number of sugar statuettes that have just been cast. When polished and varnished the sugar figures can not be told from marble figures. In special designs the sugar must be extremely fine grained to permit of delicate carvings

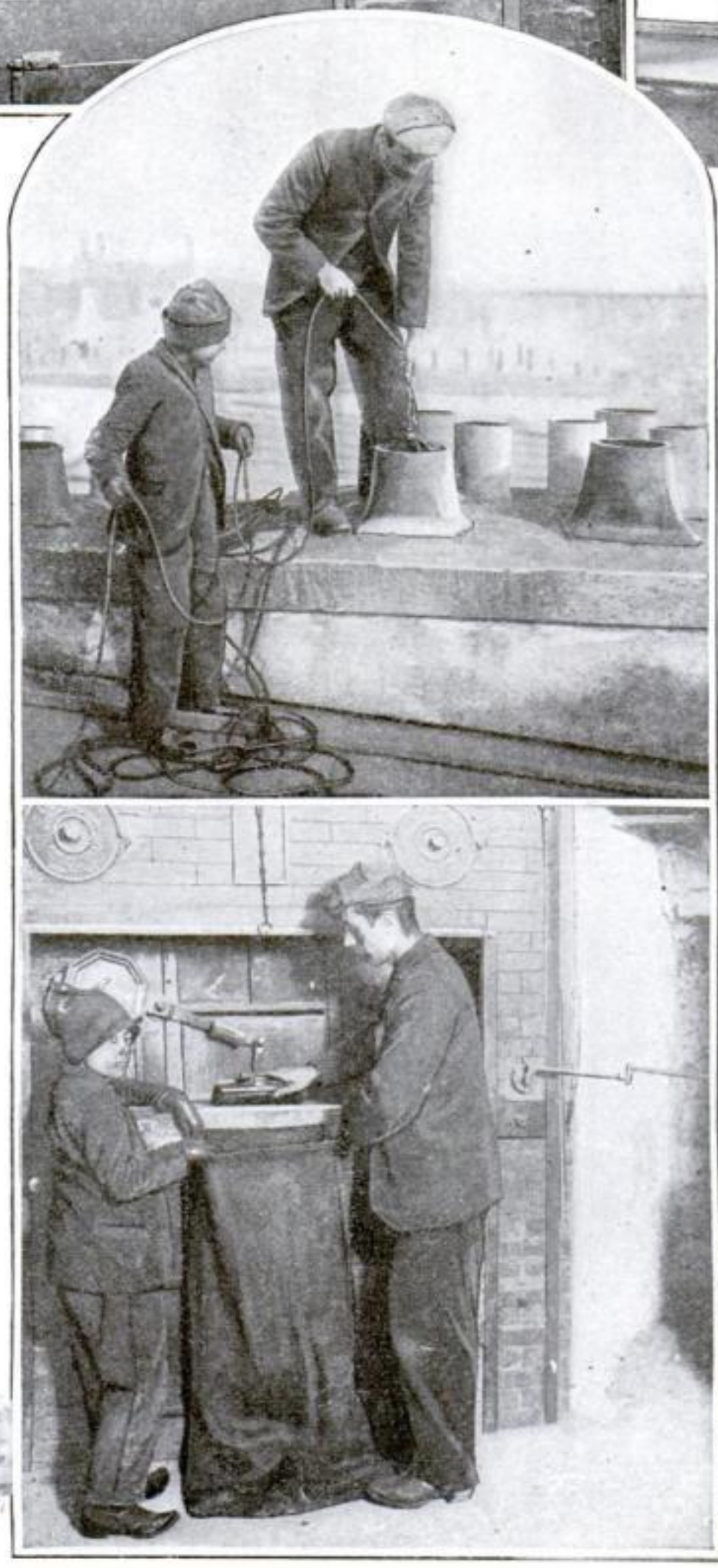


Fat mixed with tallow is run through a grinder to soften it. When in a plastic form it can be kneaded like dough. To prevent it from becoming rancid, citric acid is added to the mixture before molding

An automobile made of nuts and sugar—a good example of the confectioner's art. At the present time Paris bakers and confectioners are making their choicest sweets in the shape of fortresses, cannons, and armored automobiles

The Vanishing Chimney Sweeps of Paris

On account of the modern construction of chimneys in larger cities the day of the chimney sweep is about over. But occasionally one encounters him even in Paris. Here one is seen preparing to clean a baker's oven



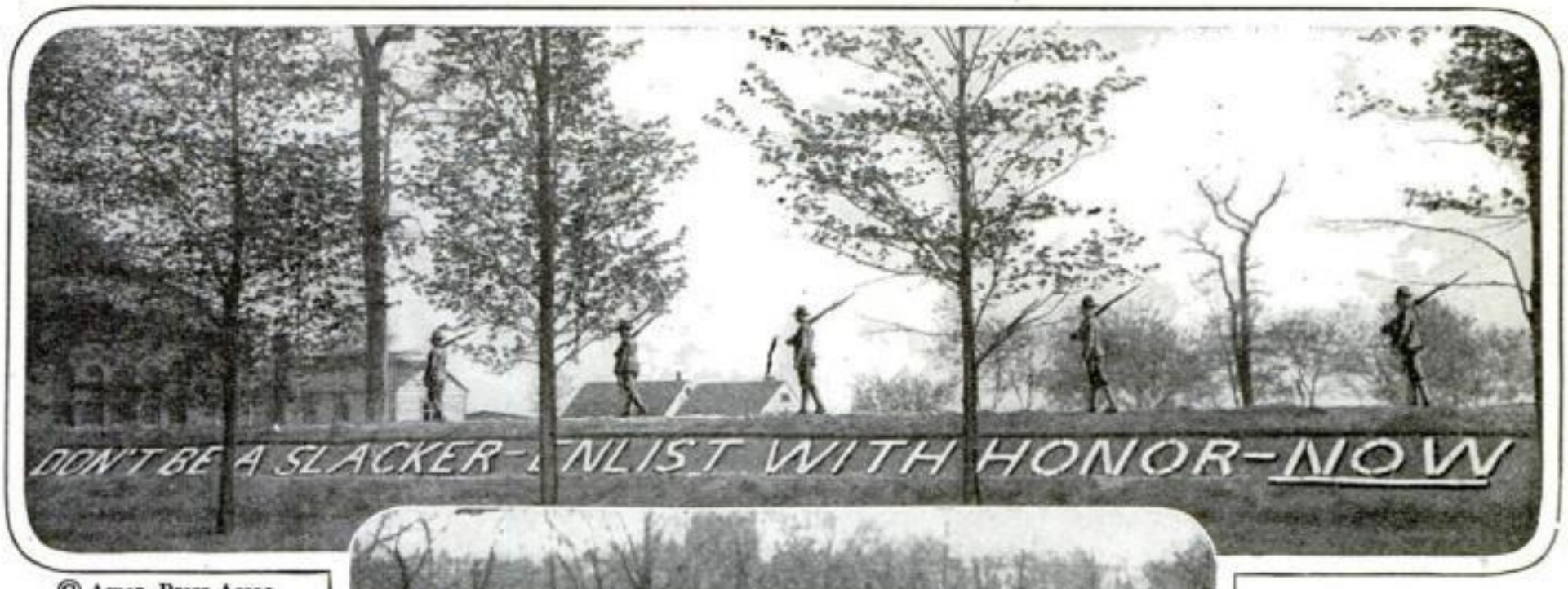
With his tight-fitting cap pulled down over his head and his soot bag fastened at his side the little gamin begins his work at about three or four o'clock in the morning so that he will have finished and disappeared from sight by the time folks are astir.

Below: The little chimney sweep was formerly a familiar sight, and his shrill call "O-o, O-o! *Voici le ramoneur!*" (Here is the chimney sweep) was one of the accustomed early morning noises of the city

An older man, called the "patron," accompanies the gamin, making his contracts and overseeing his work. Where the chimney is too small for the boy to enter, his "porcupine" brush is lowered into it. Its stiff outstanding bristles scrub the walls mechanically

When the sweeping is over the soot is brushed into a bag and carted away. The gamin requires only about ten minutes to clean out the largest and dirtiest of chimneys. His patron receives the remuneration, which grows less and less with the progress of time

Novel Ways of Recruiting in the East



Above: The message that meets the man who comes to Plattsburg, where an officers' training camp is situated. The letters are of whitewashed brick against a background of grass

At left: James White, first class fireman of the *Virginia,* aids recruiting by going through his strong-man stunts in Boston. Two lines of men are trying to break his hand grasp here

Drawing an automobile through the street with his teeth, White proves that he is the champion strong man of the Navy. He likes nothing better than demonstrating his prowess before prospective navy recruits

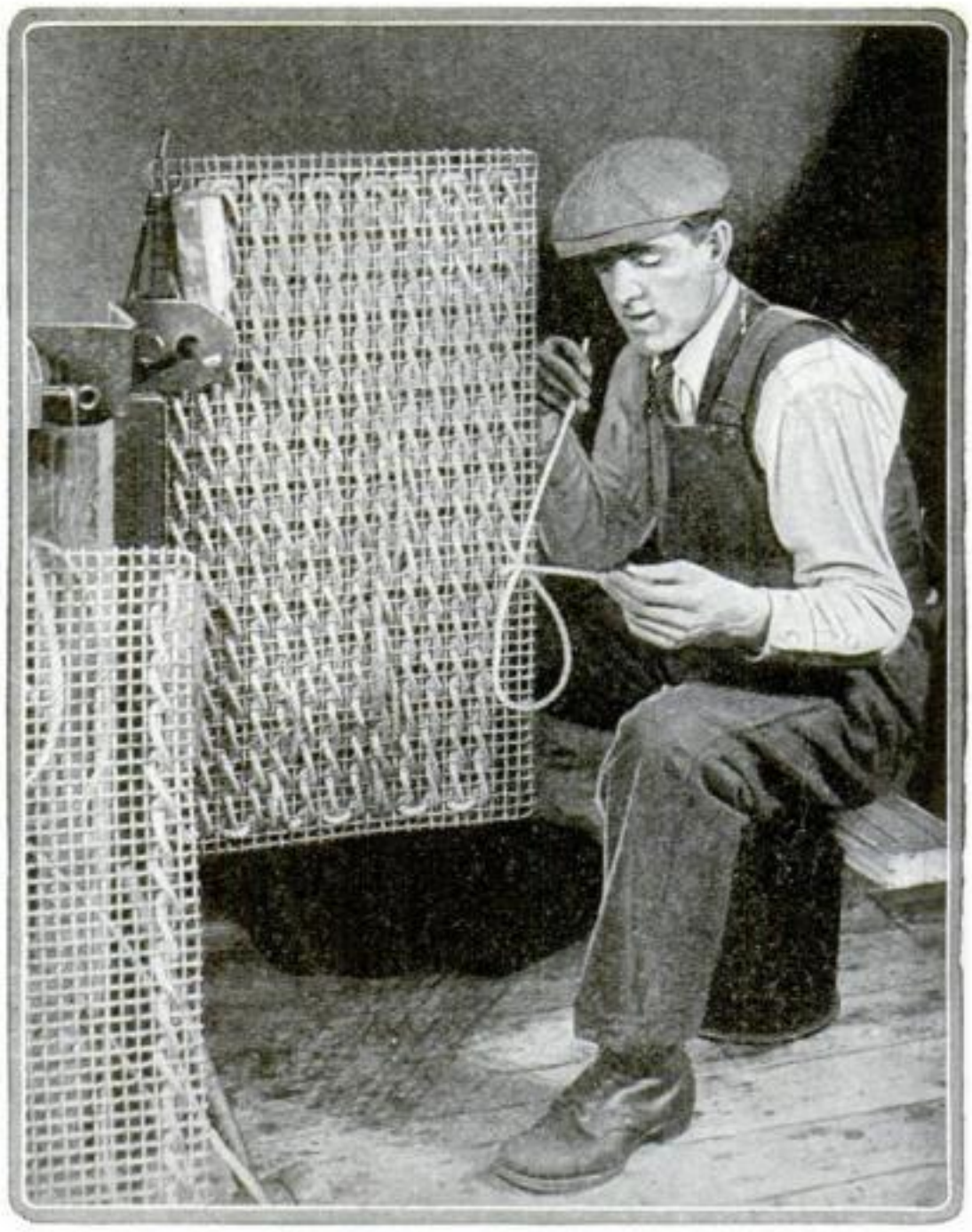
"Don't be a rube. See the world and learn a trade" is the message carried to country and city lad alike by the energetic bluejacket in flat hat and spring-bottom trousers

Photos © Int. Film Serv.

They sing on ship and they sing on land —when there's recruiting to be done— of good fellowship and exciting times

One way of making a question so effective it can not be ignored. "I am one half. Will you be the other?" reads the placard

The Sailor Is as Handy with Knife and Rope



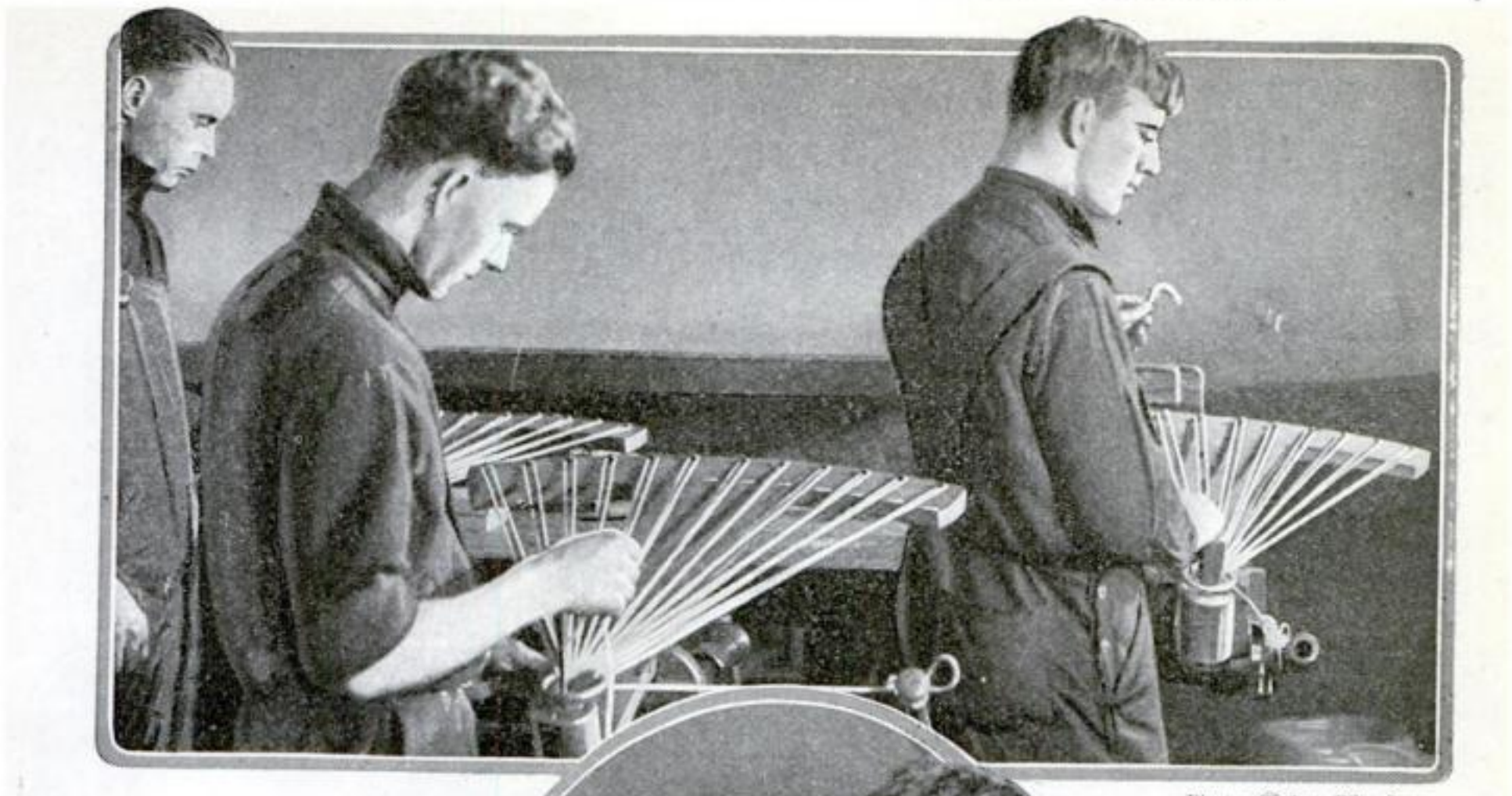
Working on a deck mat. These mats are at every door of a battleship. Heavy wire is used for the base. One-inch Manila rope is twisted and woven in and out. When finished the mat has an elaborate rope edge

Photos © Int. Film Serv.

Every battleship has several collision mats, to be used in emergencies. The mats are usually thirty feet by nineteen feet. They are made of heaviest canvas and hemp

Starting the work on a collision mat by sewing the first layer of hemp on the canvas. When the mat is complete it is covered with a thick layer of hemp and no canvas is visible .

as the Seamstress with Needle and Thread



Photos © Int. Film Serv.

The strings which support a hammock are called clews when arranged in the approved fashion. The sailors shown above can each make fifty-five clews a day. This work requires little skill and it is one of the first jobs taught to the recruits. The best and strongest of rope is essential. Hammocks serve as beds aboard ship

The man in the oval is putting the finishing touches on an extra-size bumper and padding it out. All ships are provided with bumpers, which are hung alongside to protect the hull against scratches and cuts and to break the force of the jar should the vessel come in contact with another vessel or with the sides of the pier or dock

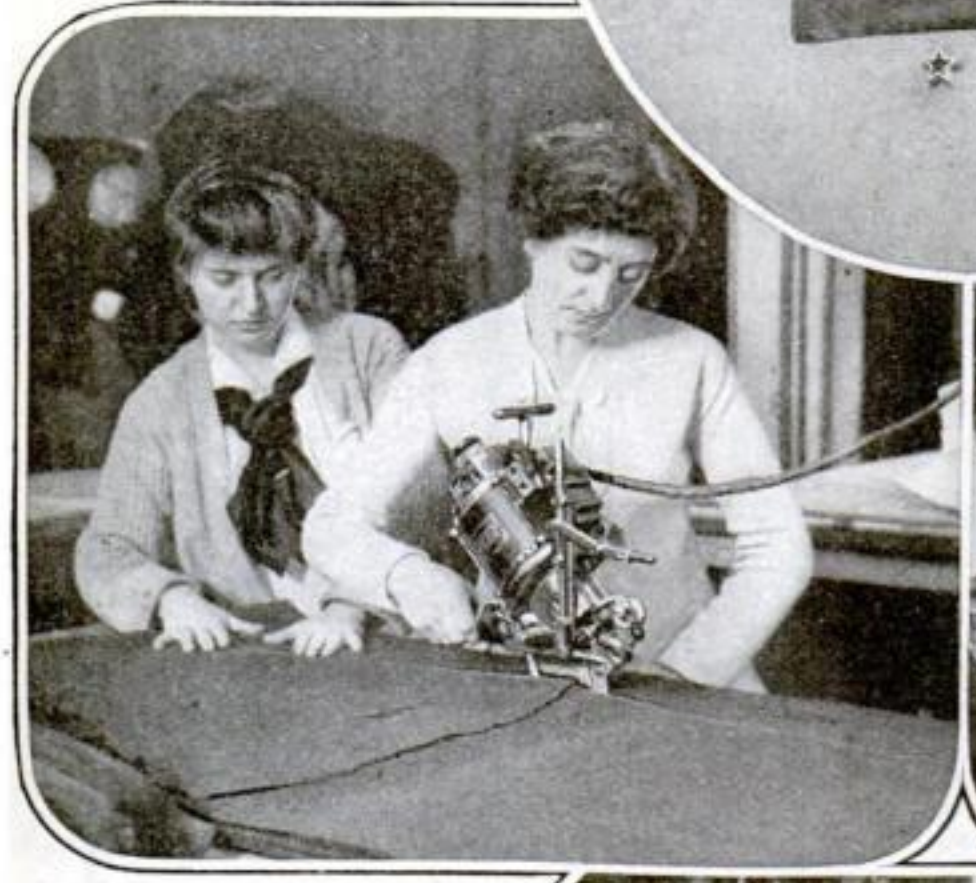
Old pieces of rope are used to form the inside of the bumper, as shown at the left. One man can make eleven bumpers a day. At right is shown the completed bumper. This is the work of a skilled expert

The Betsey Rosses of Today Engaged in the Huge

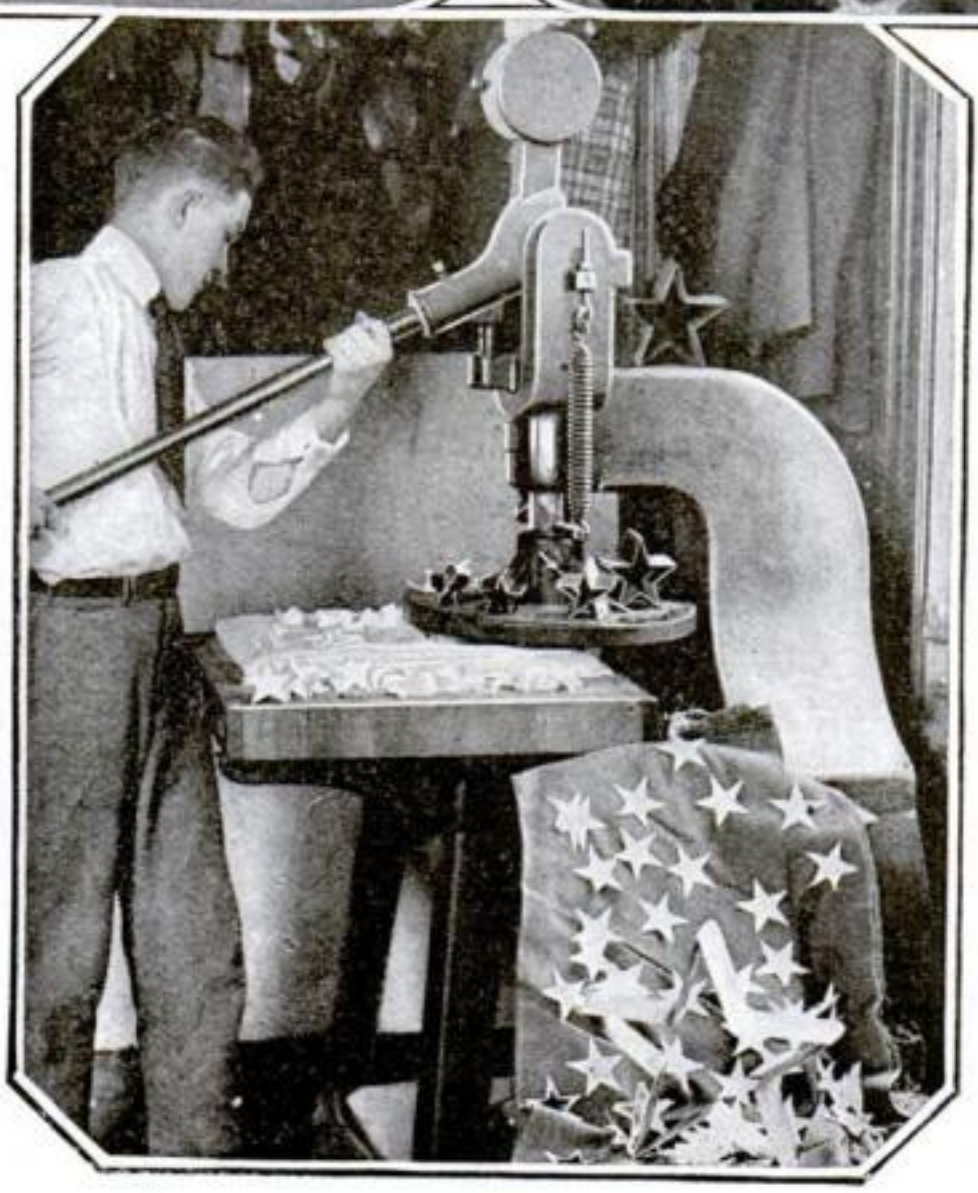
In the wave of patriotic fervor which is sweeping over the entire United States, the daily manufacture of flags and patriotic emblems of every description has run up into many millions

In spite of the fact that electrical machinery of every available type is used, the production scarcely keeps pace with the demand. At left is shown the form used in cutting out stars of all sizes

Photos © Brown and Dawson



Above is shown a motor-driven cutting machine in operation on material for the blue fields of the flags. These blue fields are cut in bulk, many hundreds of them at a single cutting. It is difficult to estimate the number of yards of bunting that have been cut up into flags since the United States announced her intention of joining the contestants in the great war



As soon as the stars have been cut out they are pinned or pasted on the blue fields and then passed on to the operators of the electrically driven sewing machines. These seamstresses turn out an incredible amount of work in a day

At left: The stars being cut in a punch press. At each operation the steel die cuts through forty-eight folds of the white bunting, making forty-eight stars—enough for one complete flag—at one time. There are dies of all sizes of stars and eagles

Task of Meeting the Demand for "Old Glory"

Photos © Brown and Dawson

The stripes are cut alternately, first red and then white, at a surprising rate of speed. Then another battery of workers sew the red and white stripes together. Big flags and little flags, of silk, felt or bunting, all are cut in the same way

The sewing on the very fine flags is done by hand, but it must be made especially strong, so that the flags will be able to withstand the flapping of the wind, which is no respecter of fine materials or delicate needlework

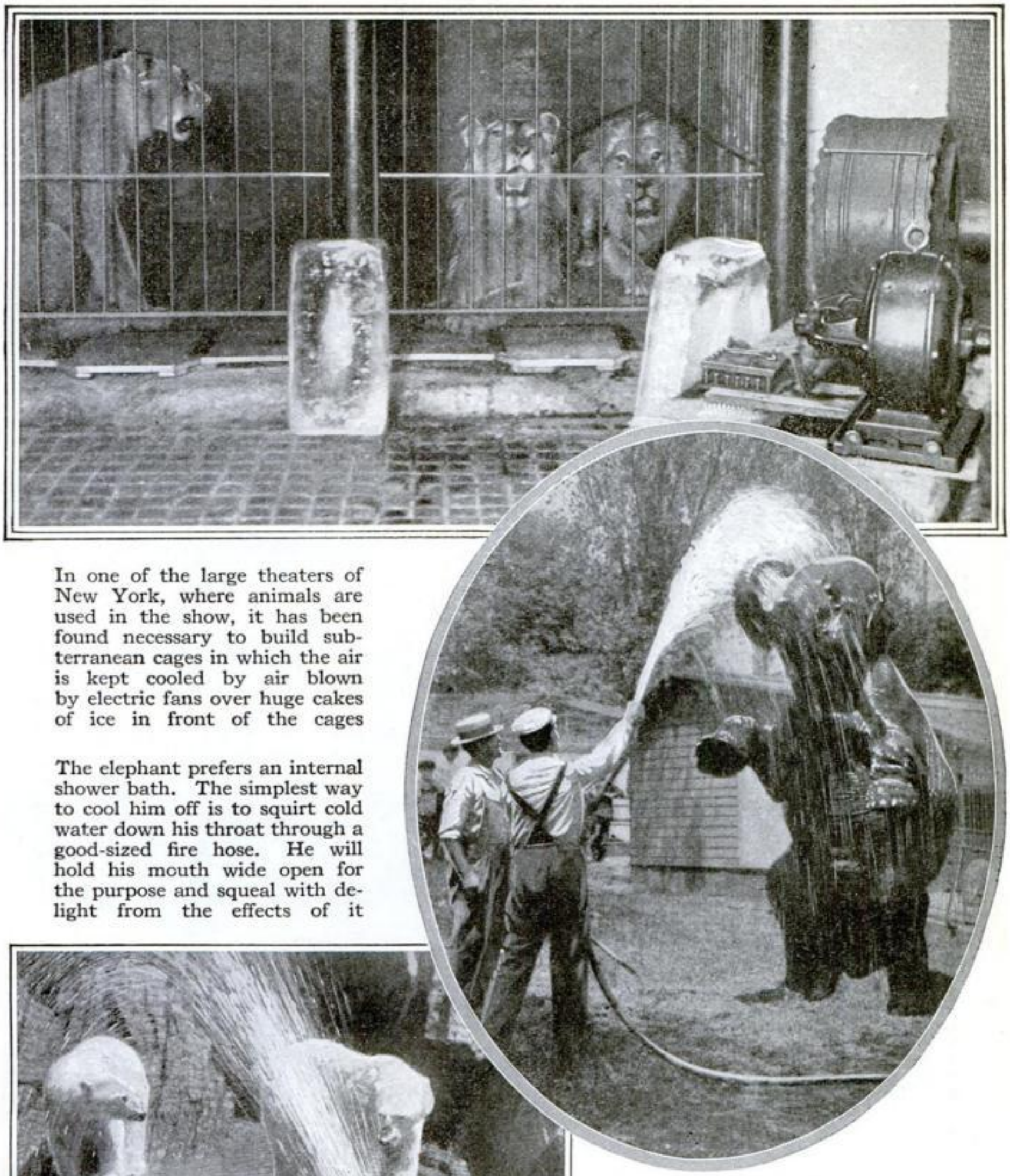
In center: For special designs, stencils are made by means of a perforating machine. A black powder is applied over these stencils to mark the design on the cloth. Then artists bring the design into relief with oil paint and brush

The machines used for the stitching are threaded with great spools of cotton containing twenty-four thousand yards each. This is fed in with lightning swiftness and the sewing is done with never a "drop" stitch

Waterspout—the Sailor's Dread for Centuries

Waterspouts have always been the dread of sailing-ship captains. In the Mediterranean, where the waterspout shown above was photographed on a January afternoon, the ocean is oftentimes lashed into foam by a series of the most violent spouts. As the photograph shows, the waterspout appears as a conical mass of cloud with concave sides rising from the water surface to meet an inverted cone of cloud. The phenomenon started as a whirlwind over the sea during the prevalence of a humid atmosphere. The rise of heated air is accompanied by inrushing wind, which literally churns up the water into waves, and the water and foam are sucked upwards. Fish and frogs have been carried inland by waterspouts. From this fact the expression "Raining bullfrogs" probably originated

Making the Summer Bearable in the Zoo



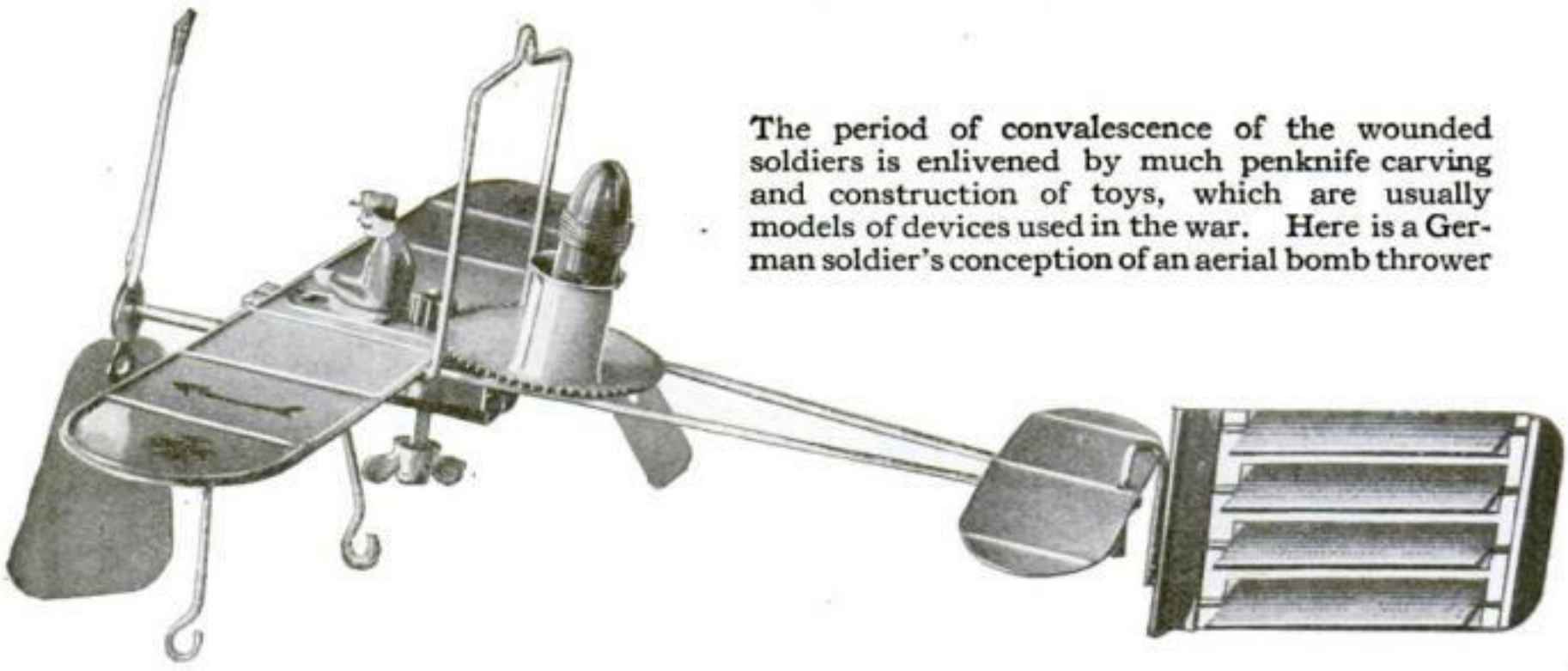
In one of the large theaters of New York, where animals are used in the show, it has been found necessary to build subterranean cages in which the air is kept cooled by air blown by electric fans over huge cakes of ice in front of the cages

The elephant prefers an internal shower bath. The simplest way to cool him off is to squirt cold water down his throat through a good-sized fire hose. He will hold his mouth wide open for the purpose and squeal with delight from the effects of it

Photos © Amer Press Assoc.

Polar bears suffer even more than their brown brothers from the summer heat. The keepers of the Bronx Park "Zoo," in New York city, spray the animals daily. The bears will pose like statues on a ledge of rock while the hose is played on them. The cubs are given ice water to drink through nursing bottles

Soldiers' Art Exhibit at Leblanc's Museum, Paris



The period of convalescence of the wounded soldiers is enlivened by much penknife carving and construction of toys, which are usually models of devices used in the war. Here is a German soldier's conception of an aerial bomb thrower

French Official Photos

The photograph above is a model machine gun mounted on a platform intended to resemble the deck of a boat

At left: A statuette of a German prisoner, made by a Frenchman. He is supposed to be securely tied to the stake

At right: A figure throwing hand-grenades. He is equipped with all the necessities for hand-to-hand fighting

President Wilson's Message Reaches the Germans

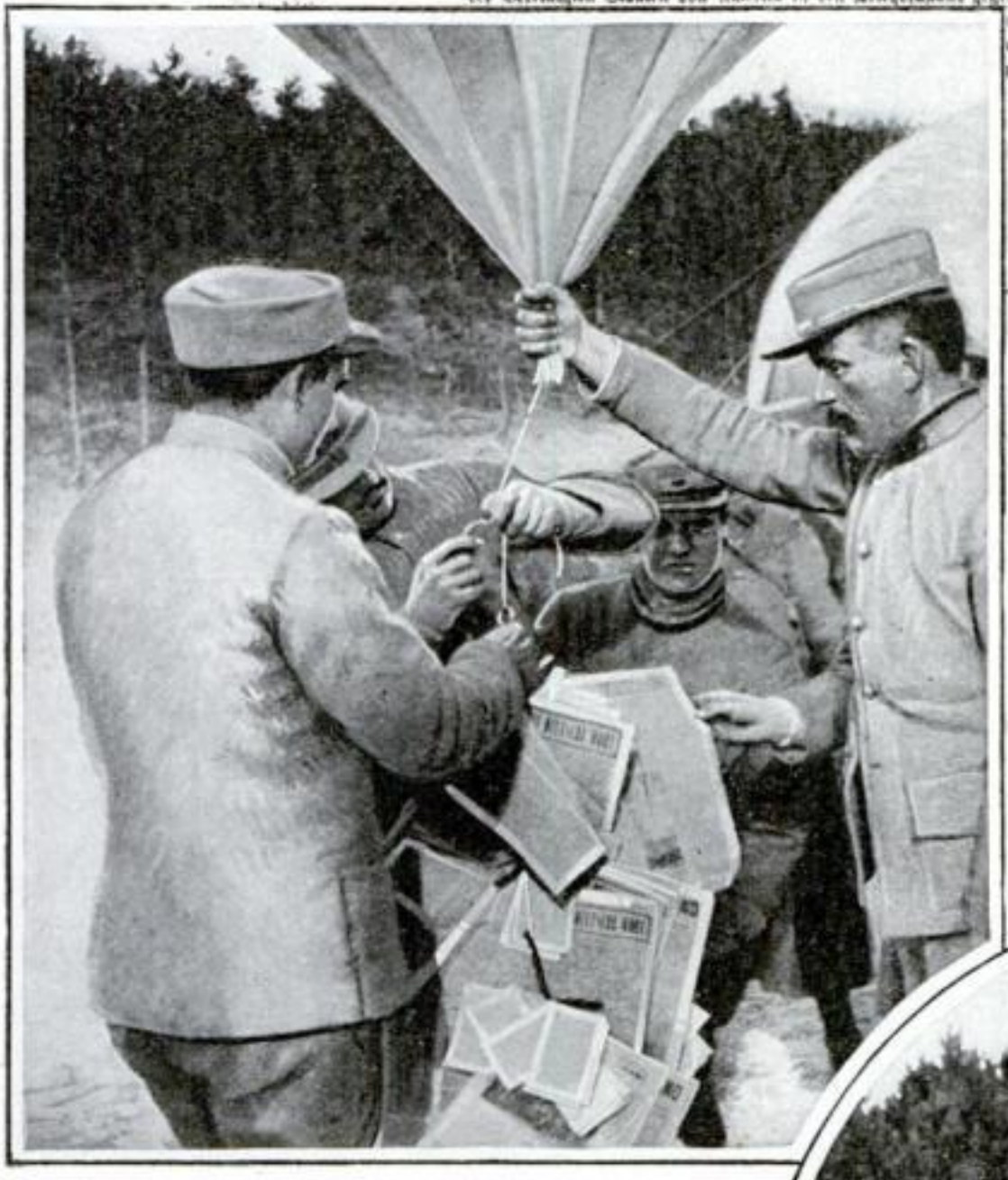
Rede des Präsidenten

Wilson

gehalten am 2. April 1917

im Kongreß zu Washington.

Die deutsche Regierung hat es nicht gewagt, dem deutschen Volke den vollständigen Text der Rede unseres Präsidenten Wilson vom 2. April 1917 mitzuteilen. Wir denken, daß das deutsche Volk, dessen Helden unter diesem neuen Kriege sich ins Ungeheure



© Int. Film Serv.

President Wilson's message to Congress (translated into German) which proclaimed to the Germans in the trenches that the United States had taken up the fight in the name of humanity and that right is more to be desired than peace

Above: Several copies of President Wilson's war message attached to a balloon. Only parts of the message were printed in the German papers —the least important parts. That is the chief reason for the procedure

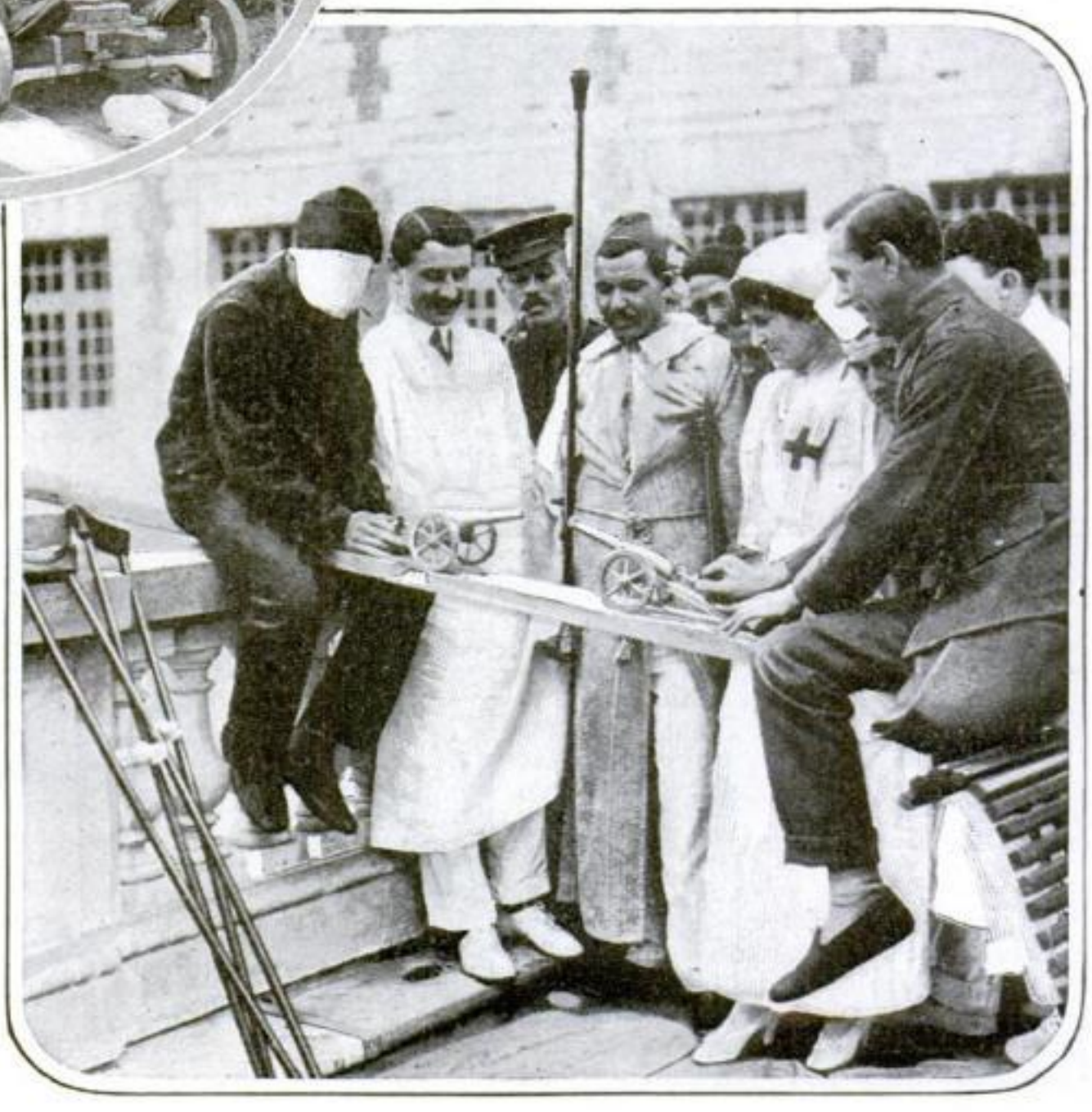
How the balloons carried the message to the German trenches. An American business man contributed a large sum to be spent in distributing the message, which thus reached the German ranks uncensored

Recreation for the Wounded and for Prisoners

Wounded British soldiers listening to a musical comedy performance through an electrophone service contributed by public-spirited people of London to the hospitals of that city. Even the baby elephant mascot seems to be enjoying the performance

Photo © Amer. Press Assoc.

Above: A prisoner's trolley car, made out of odds and ends found in a detention camp. Going down hill the man behind operates the brake; going up hill he gets off and pushes. As a general rule prisoners are kept busy



A pop-gun sham-battle between two wounded soldiers enlivens a dull hour in a British hospital. The toy cannons operate on the same principle as the pop-gun. One of the soldiers has suffered the loss of an eye; the other, a leg

Queer Trees and Near-Trees—All Are Useful

Photos © Brown and Dawson

Although the spongy wood of the silk-cotton tree, found principally in Jamaica, West Indies, is too light to be of commercial value, the natives make canoes out of it and fill pillows and cushions with its long silky threads. Its root-formations make the tree earthquake-proof

Bamboo belongs to the grass family, although its tall stalks resemble saplings. As material for rafts, fishing poles and even for houses it has been in use since the world was young. Orientals consider the young shoots, which resemble asparagus, a nutritious food

The banyan tree, on account of its habit of putting forth numberless trunks to support its branches, thus crowding out all other trees, is regarded as a robber and murderer. But it yields rubber equal to Para—and once, centuries ago, it sheltered a Buddha

The Automobilist's Mechanical Cost Keeper

It tells the mileage of the car, the life of each tire, and the gasoline and oil consumption

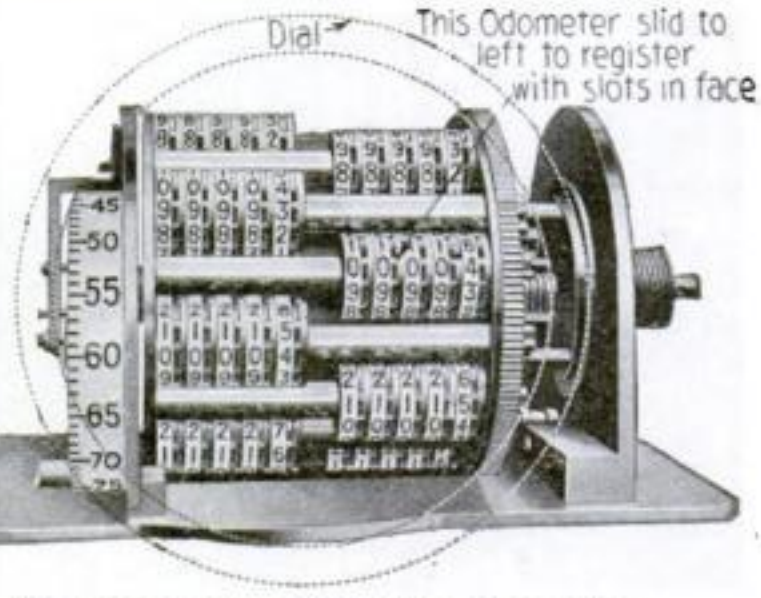
THE latest device for the convenience of the automobile owner who desires to keep a complete record of his car operation is an instrument on which can be read at will the car speed, the trip mileage, the total mileage, the mileage of each of the four tires in use, the two spare tires usually carried, the gasoline and oil consumption and warnings at 500 and 1,000 miles of running to indicate that adjustments, greasings, etc., are necessary. These thirteen records can be read as desired.

The device is no larger than the ordinary speedometer and is mounted on the dashboard in the conventional manner. It is driven by means of one flexible cable to the front wheel or to the engine propeller shaft, as desired, and consists of thirteen separate odometers, operated in sequence by a series of spring-pawls. All of the readings are obtained from the mechanical operation of the odometers and of the driving means, with the exception of the gasoline and oil records, which are manually operated and must be set each time gasoline is put into the fuel tank or oil into the engine crankcase.

As shown in the accompanying illustrations, the thirteen odometers, nested within a casing on the opposite ends of parallel shafts, are covered by a ring-dial, around the circumference of which are divisions for each of the thirteen records. In the dial face is a slot in back of which the various odometers are moved according to the record desired. Those odometers to the right of the nest, as shown, are slid over to the left on their shafts by means of turning screws on the face of the instrument so that the figures register properly behind the slots in the dial, the latter being turned in the same operation.

How the mileage of tire No. 4 is recorded on the instrument

The device consists of thirteen separate odometers, operated in sequence by a series of spring-pawls in a casing surrounded by a ring dial having thirteen partitions for records



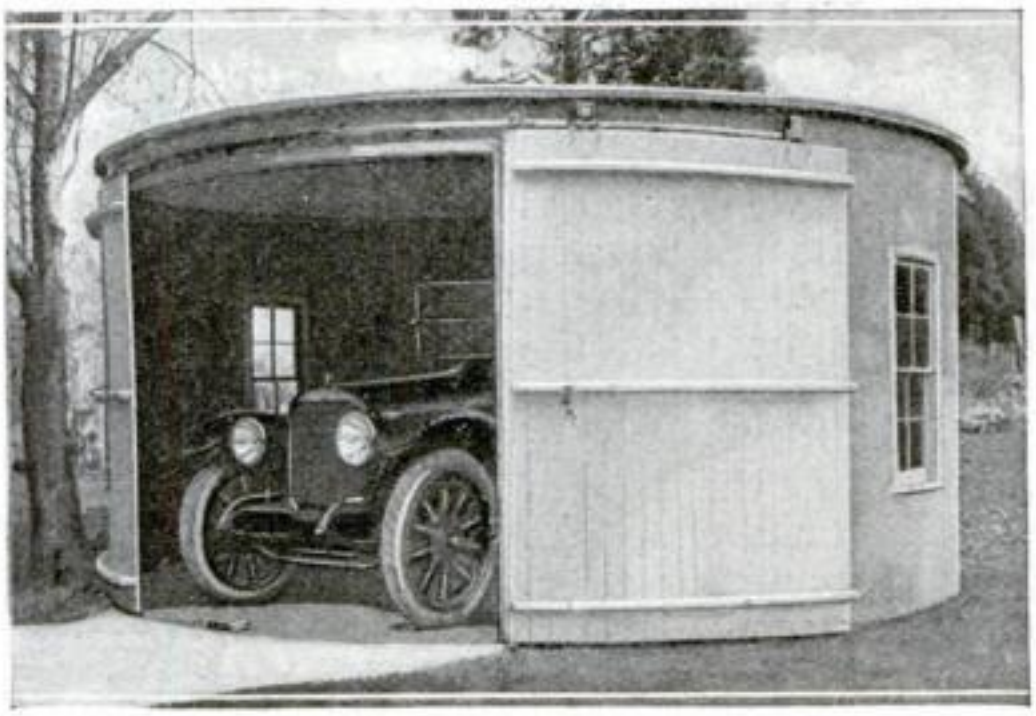
Turning screws slide the odometers from right to left on their shafts

When a new vehicle is purchased and the device attached, all odometers are set at zero. The speed in miles per hour, the trip and total mileage are registered in the usual manner; one odometer serves to give the same reading on each of the four tires fitted. If tire No. 1 was removed at 1,000 miles, the face of the dial would be

turned until this reading showed through the slots. Then by turning the knob shown on the casing, this odometer would be thrown out of engagement and the odometer for the new tire, No. 5, engaged. If this tire ran 1,000 miles before removal, the odometer for tires 2, 3, and 4 would each register 2,000 miles at that time. As tire No. 6 was put on in place of No. 5, these mileages would be automatically added to until the tires were taken off, at which time the respective odometers would register accurately the mileage covered.

The miles per gallon of gasoline or miles per quart of lubricating oil are obtained by pencil and paper calculation.

A Circular Garage for the Farm, Built from Silo Forms



The walls of the circular garage are eight feet eight inches high and are reinforced with wire mesh

SILO forms previously used on a Missouri farm were employed to build the novel circular concrete garage shown in the accompanying illustration. It cost about one hundred and fifty dollars and is sixteen feet in diameter, with sufficient space on each side of the car for work bench and vise. It is entirely of concrete except for the two-part wood doors and window sash. The walls are four inches thick, reinforced with wire netting. The floor and the roof are also of concrete, the latter with a three inch slope to the foot.

Inflate Your Tires to Full Pressure, Even in Hottest Weather

"LOOK out! Don't inflate that tire to full pressure on a hot day like this," is the costliest warning ever hurled at motorists. Instead of saving tires and money it has cost automobile owners millions of dollars. True, a tire does expand in hot weather, but so slightly as to be negligible in its effect. It never expands to the danger point. Furthermore, internal heat does not result from the temperature of the outside air, but from the constant bending of the tire as it travels along. Consequently, when you run your tires under-inflated in hot weather to combat air expansion, you cause increased bending of your tires, and thus create more heat—which is just the condition to avoid. The thing to guard against is under-inflation.

The measuring device for determining whether a person is right or left handed naturally

Use Your Natural Arm If You Would Be a Good Craftsman

THE brachiometer (don't be frightened at the name) is an instrument which has been devised by Professor H. Franklin Jones, of the University of South Dakota, to determine whether an individual is naturally right or left handed. Every person is born with a major and a minor arm, and Professor Jones, through study of this fact, has discovered things about the man who is jack of all trades and master of none.

To determine "handedness" he measures the bones of the arm with his brachiometer. If you were born with a left major but adopted the right, the fact will be shown by measurement of the relaxed forearm circumference, contracted forearm, relaxed biceps and contracted biceps. To become master of your trade you must use your major arm.

Roadtown—The Commuters' Utopia

Vitalizing the country with arteries of energy and life from the city

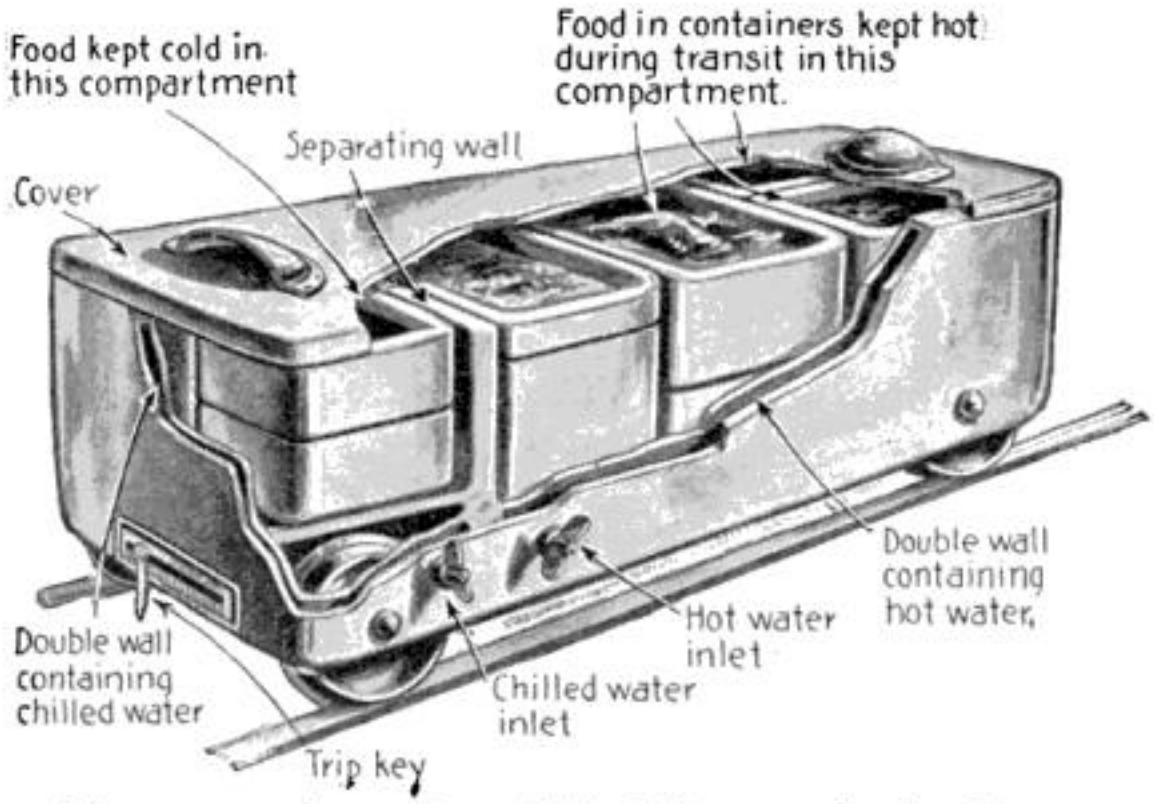
By Max Fleischer

MR. EDGAR CHAMBLESS, who has devoted half a life-time to housing problems, has conceived Roadtown, which, if carried out, should give us all the advantages of the country with none of its disadvantages. The Roadtown plan of housing may be compared with the modern skyscraper hotel or office building. The vast number of tenants occupying these buildings, closely alined for economic distribution of light, heat, power, vertical transportation, etc., by means which are self-contained within the structure, make it possible to rent an elegantly appointed room or modern office at a very moderate figure. But is it necessary to go up into the clouds against gravity to minimize the operating cost?

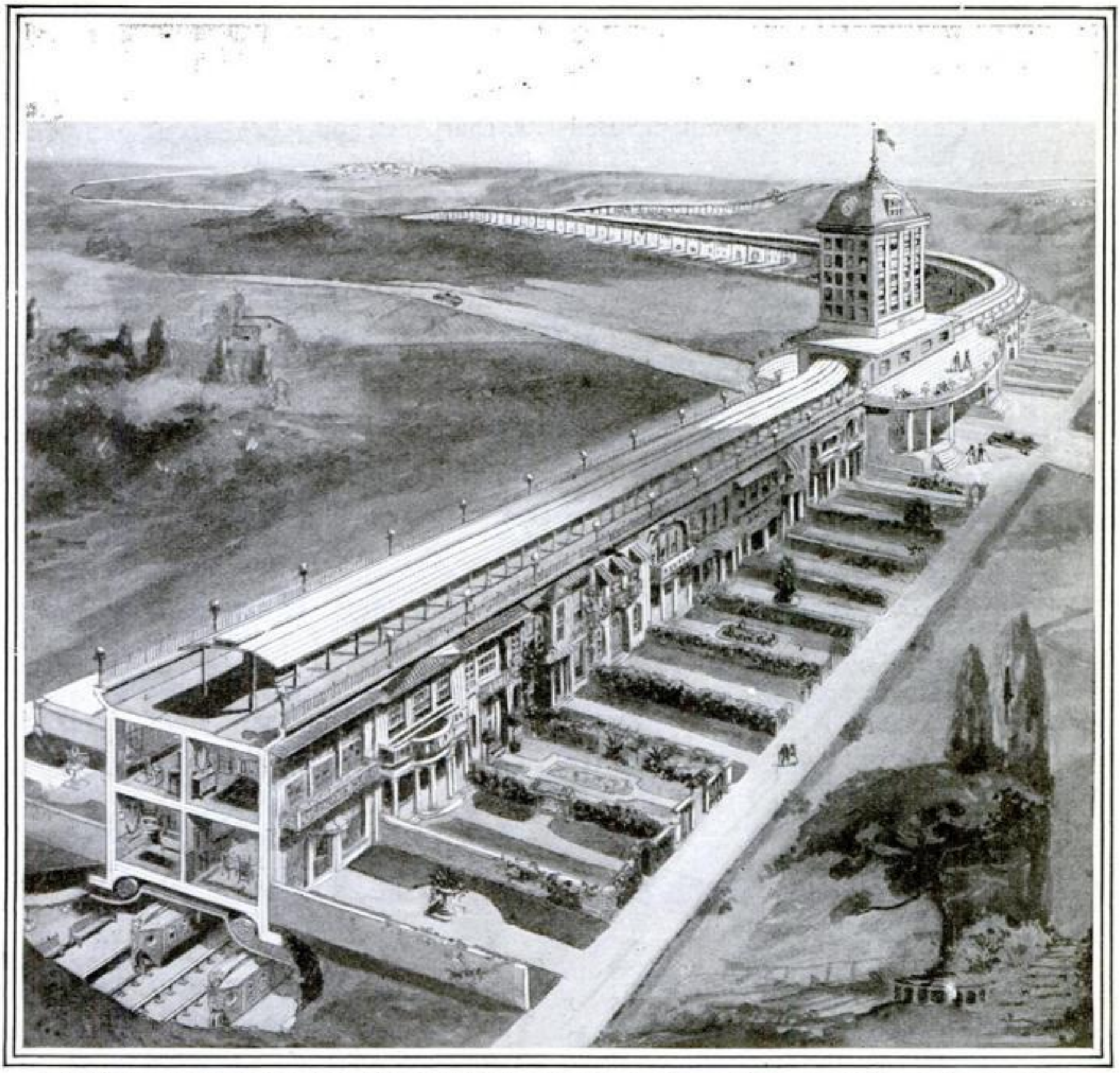
To see Roadtown through the eyes of the inventor, imagine a hotel skyscraper miles in height, as many miles as you dare imagine. Try five hundred miles at least. Have it fully equipped with every conceivable modern convenience, complete in every detail. Now, carefully lay this building on its side until it reaches far across the country. This is Roadtown—a continuous unbroken line of two-story reinforced concrete residences reaching hundreds of miles out into the open country. What were the elevators in the skyscraper are now the Roadtown subways running in a trench under the building. The lighting, heating and distribution problems for these residences on the farm now solve themselves for you. In such a building it seems possible to live in the country—with every city convenience.

One may live a hundred miles from his office in the city and commute; for distance along Roadtown should be calculated by time rather than by miles, since it is planned to have, in addition to local service, express trains traveling at terrific speed (over 200 miles per hour is not an impossibility with the Boyes Monorail), and as silently as the skyscraper elevator in its vertical plunge. Rows of screened windows under the porches of the houses will ventilate the subway.

Referring to the illustration, it will be noted that each house will have two private front gardens, one on either side. There will be no rears to these houses—nothing erected to obstruct light and ventilation. Each house will be twenty-one feet wide by twenty feet deep and contain seven good-sized rooms. The walls, floors and ceilings will be of cement and sound-proof. Stairways will give access to the subways and to the continuous roof, which will be a roadway for pedestrians, skaters and light, rubber-tired vehicles. It will be illuminated at night with electric lights. A covered promenade in the center of the roof will protect the pedestrians from rain. In the winter, it will be steam-heated, enclosed with glass panels. The promenade will thus be converted into a continuous sun parlor. At intervals, towers will be erected which will be used as social and shopping centers and contain schools, public service stations, libraries, theaters, heating-plants, telephone centrals, etc. The distance between these towers will be determined principally by the operative



The automatic carriers which deliver meals already prepared from the community kitchen to the consumer's home



Imagine a skyscraper hotel miles in height—say five hundred miles—and fully equipped with every modern convenience. Now lay this skyscraper carefully on its side on the ground, so that its elevators will be subways running in a trench under the building which will extend, in a straight line or in serpentine coils, miles out into the open country. This is Roadtown

efficiency of the public utilities contained therein.

Being operated on the plan of an immense hotel, individual kitchens will not be necessary—the Roadtown kitchen nearest you will take your telephone order, and by means of automatic carriers running on a horizontal track, deliver your favorite dish right into your dining-room. These carriers will be arranged to preserve the heat in the food during transit, one section of the carrier remaining chilled for cold dishes. The meal finished, the carriers will be returned to the community dish-washer. The carriers will run along a single track and will be automatically switched to its proper recipient by a trip-key, similar in action to the type-distributing feature of the Linotype machine.

Evidently, to make doubly certain that our new "city farmer" will have every advantage of civilization, the inventor of Roadtown proposes to instal a number of utilities some of which are at present available only to the rich. For a better idea of this intention, it may be well to describe briefly those at present under consideration.

The temperature of each room will be automatically regulated to suit its particular occupant, by the use of the thermostat attached to the steam radiators. In very hot weather the refrigerating plants will pump cooled water through the radiators. Running distilled water, cooled to a health-

ful temperature, will be used for drinking. Heavy doors and windows will be moved automatically by compressed air. Gas disinfecting pipes will lead to each residence.

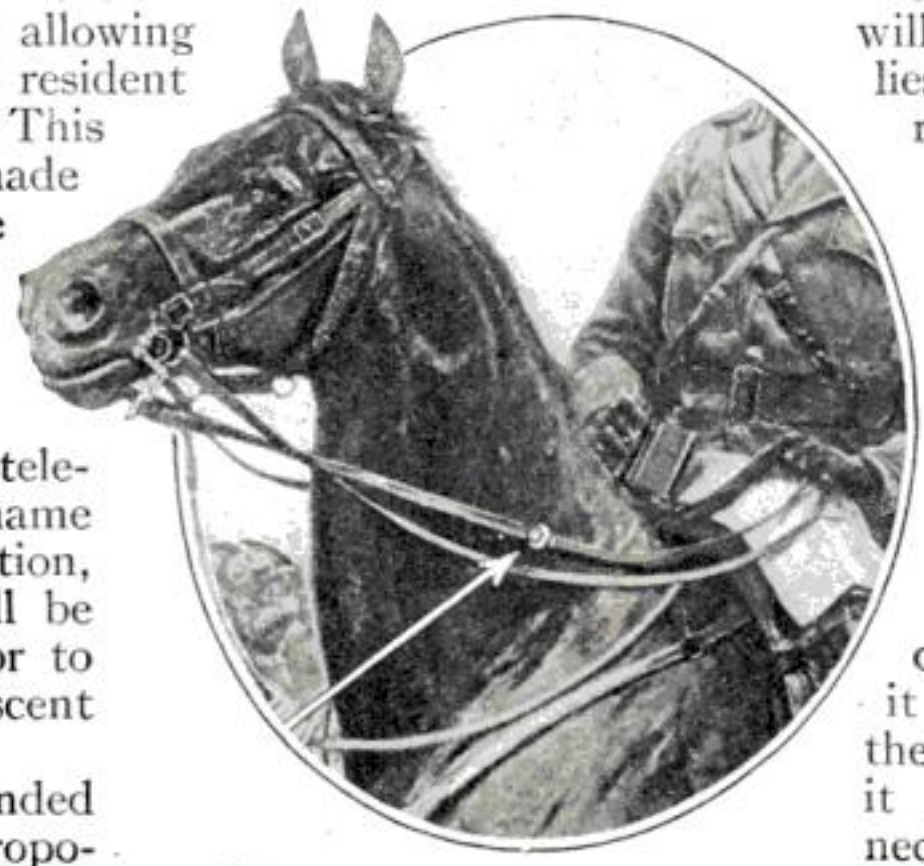
Vacuum cleaners will be installed. Bell announcers will signal a few moments in advance the arrival of a train to the nearest station, allowing sufficient time for the resident to be on the platform. This signal device can be made inoperative at will. The dictograph will entertain, lecture, sing or play for you when you do not care to go out. By simply telephoning central the name of your favorite selection, the entertainment will be wired to your room or to the room of a convalescent patient.

To the practical-minded man the Roadtown proposition may now begin to assume the thinness of a fantastic dream, too good to be true. But, is it? The society recently organized to further the interest in Roadtown is receiving the cooperation of architects, engineers, builders and scientists. Among them are level-headed thinkers who are not readily bowled over by a fascinating but impractical venture, such men, for instance, as Mr. Boyes, inventor of the monorail, M. K. Turner, inventor of the dictograph, and Thomas A. Edison, electrical wizard, who has donated his cement-pouring patents to the Roadtown Society.

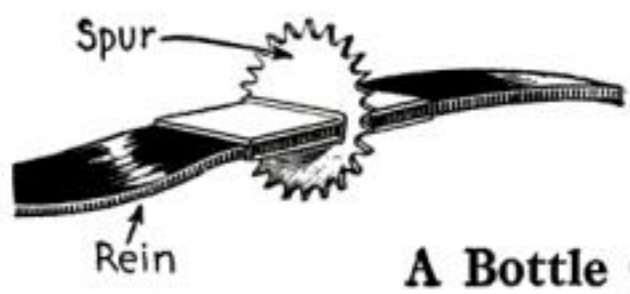
Estimates, costs and statistics are being rapidly compiled, and in view of the extreme economy of building in a continuous line, utilizing one mold for hundreds of buildings, of purchasing building material in wholesale quantities, and the economy of close alinement, it has been estimated that one of these seven-rooms and bath Roadtown residences could be rented for twenty-one dollars per month.

A New Spur Is Carried on the Reins—Not on the Heel

IF you dig a horse in the ribs with nicely sharpened spurs, he runs. You naturally assume that if you dig him in the back in like manner, the result will be the same. Herein lies the reason for the rein spurs invented by B. E. Jordan, of Hugo, Okla.



The spur strikes the horse's neck. It is attached to the rein within easy reach

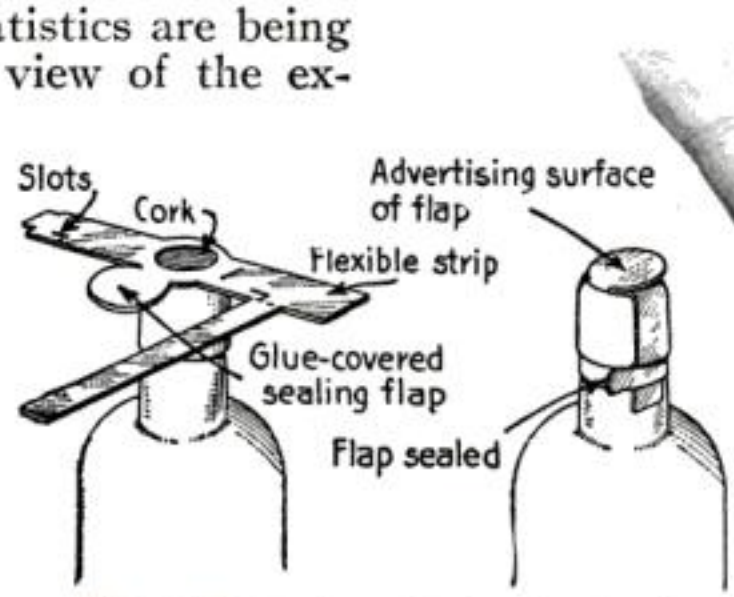


The spur consists of a circular piece of steel which is attached to metal plates that hold it in position on the rein. The sharp points on the edge of the disk complete the spur. If it is sufficiently sharp the driver need only drop it gently on the horse's neck and, as the inventor says, "he will be goaded into activity." The principal advantage which the rein-spur has over the heel-spur is recognized when the rider has occasion to dismount and walk awhile.

A Bottle Opener Which Will Not Break the Cork

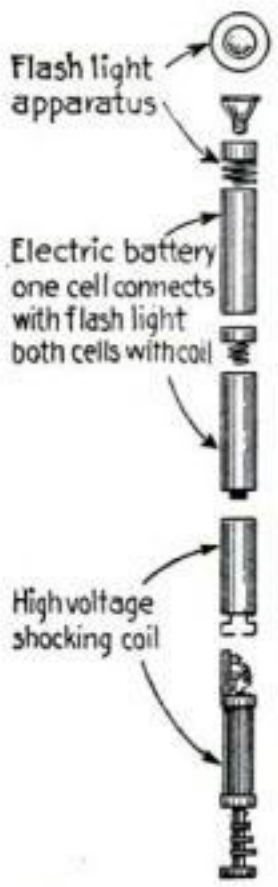
IN opening a bottle with the ordinary corkscrew, it often happens that the cork is broken and difficulty is found in removing it without dropping crumbs of cork into the contents of the bottle, or of pushing the broken cork itself down into the bottle.

In the illustration below a device is shown which eliminates all the bother connected with the opening of the bottle. It is in the form of a loop glued to the top and around the sides of the neck of the bottle, by means of which stopper, seals and labels may be removed.



The self-opening device is glued to the neck of the bottle. It rolls over to form a thumb-loop

Protect Yourself Against Highwaymen with an Electrified Cane



Details of the flashlight cane with its shocking coil

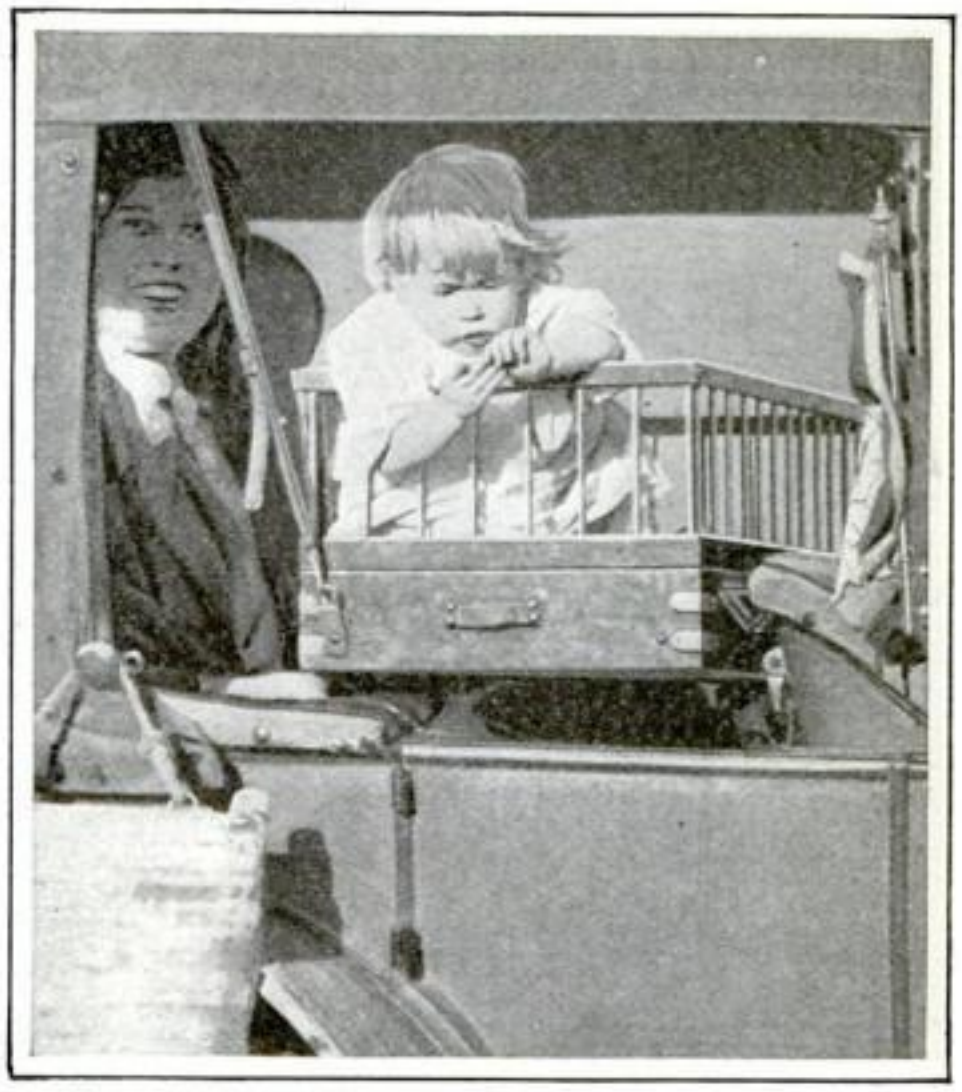
ATTACKED by a prowler, springing at you in the dark, how would you defend yourself? One young American believes he has solved the problem by an electric cane which would paralyze the muscles of the assailant in a twinkling. The cane is loaded with a high tension shocking coil and electric batteries. These add weight to the cane so that you can wield it with effect, and—what is still more important—prevent your assailant from pinning the cane down so you cannot use it. Press a button—and you electrify the cane and give him a shock which causes him to drop the cane immediately.

The electric coil is merely an unusually powerful medical coil of an elongated type. It fits into the hollow of the lower end of the cane with the two dry cells that are connected with it. The "business" end of the shocking coil is led to the metal plating which covers the entire lower half of the cane. While the shock from the cane will never kill a man, it will surprise him enough to throw him off his guard and upset his plans.

The cane is further equipped with a flashlight set in its knob. One cell is used to operate it. The upper end of the cane, carrying the electric bulb and this cell, can be detached and used as an ordinary portable flashlight.

Such efficiency in a cane makes it a good companion on a trip through the woods or in the summer camp. Although it was originally intended for protection against human prowlers it is equally successful against four-footed ones, even the largest of them.

The lower end of the cane is metal-plated so as to be electrified by the high tension coil inside



The folding crib in use in the automobile. When no longer needed it folds up into compact form

A Folding Crib in the Automobile and Summer Camp

WHAT shall be done with the baby when the family decides to go automobiling? The question is answered by a new crib which can be carried in the car and which can fold into a very small space and in such a shape that it can be disposed of readily when not needed.

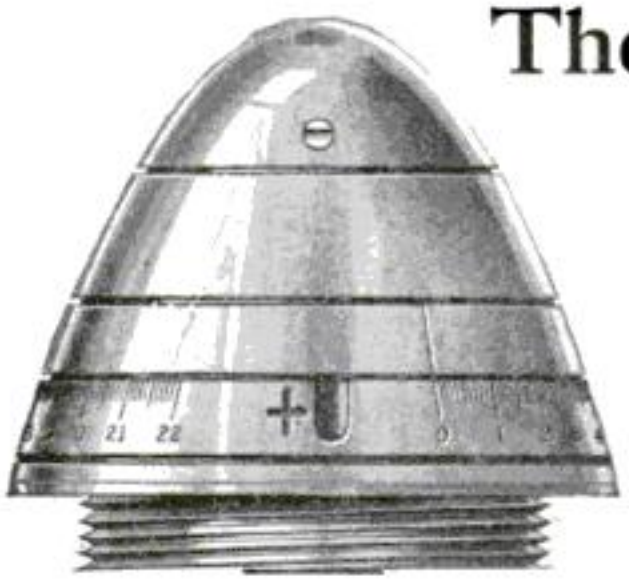
The crib is very compact. It can be carried edgewise on the back of the rear seat against the back wall of the automobile top, and it does not protrude or interfere in any way with the occupants of the tonneau. Or it can stand on end by the robe rail without inconvenience.

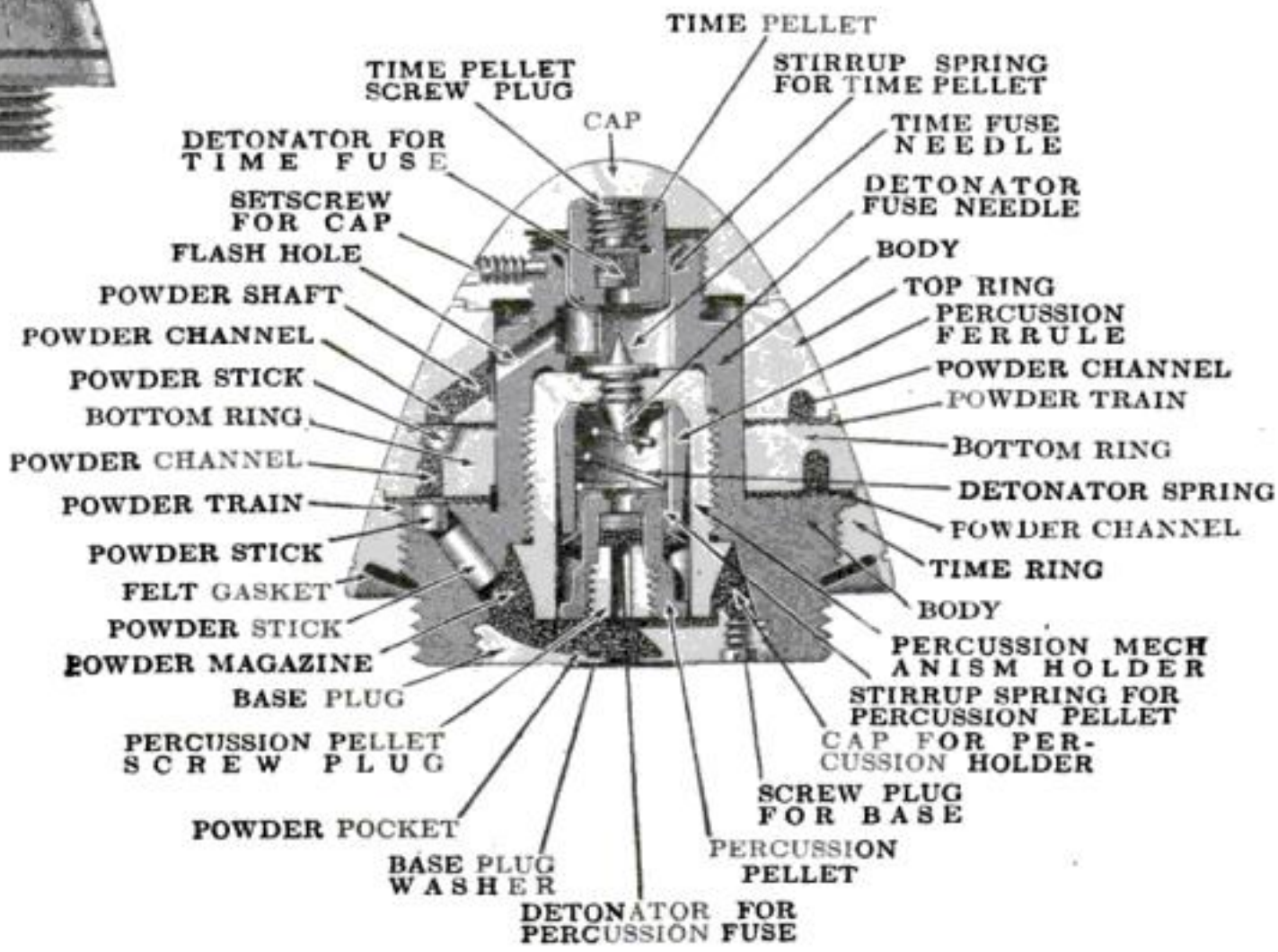
In use the crib occupies the space between seats, and gives the baby considerably more freedom of action and comfort than if he were held continually on the lap of an adult. In camp, the crib is set up as at home.

The Time Fuse and How It Works

The number of feet, yards or miles which the projectile is to travel can be accurately gaged by simply turning the time ring

By Reginald Trautschold, M.E.





The time fuse forms the tip of the nose of the projectile. It is in five parts: the body proper, its cap, and the top, bottom and time rings. Fitted between the cap and the body is a time pellet held in place by a stiff stirrup with bent-over ears and containing a detonator of highly explosive material. Under the time pellet is the fuse needle

YOU have read in the war dispatches that the "troops advanced under a curtain of fire." What does that mean? Simply that a barrage of bursting shells, hurled over the advancing men into the enemy's lines, forms a protective screen. In order that this curtain of fire may be a real protection, however, and not a terrible menace, it is absolutely essential that the men who fire the guns should have precise control of the point at which the shrapnel or high-explosive shells are to break. It is easy enough to imagine the demoralization within the advancing lines if the men had to fear bombardment from the rear as well as the enemy's fire.

That danger has been practically eliminated by the perfection of the time fuse. By simply adjusting the time ring of the fuse the gunner can predetermine the exact point—be it feet or miles from the muzzle of the gun—at which the projectile is to do its deadly work. Shrapnel, and the even uglier high-explosive shells, may be exploded if desired within a hundred yards from the muzzle of the gun, notwithstanding the fact that the projectiles start on their mission of destruction at the rate of about 1,350 miles per hour. On the other hand, they may be sent whirling through space for miles. It all depends upon the adjustment of the simple little time ring of the fuse.

The time fuse is an ingenious little mechanism which forms the tip of the nose of the projectile. It contains a time pellet and a detonator of highly explosive material.

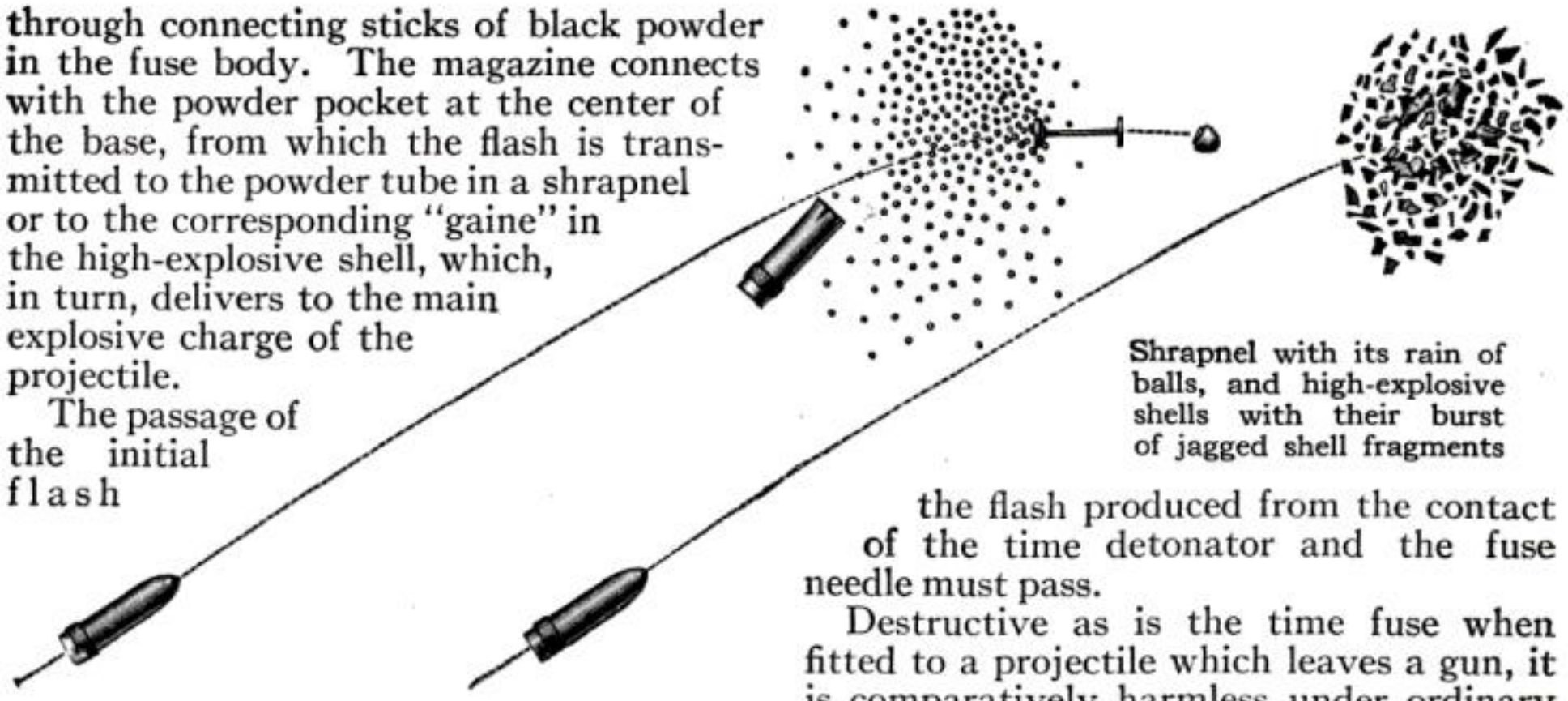
On leaving the muzzle of the gun, the projectile, traveling at a speed of close to 2,000 feet per second, is literally shot away from the time pellet, the bent-over ears of the stirrup which held it in place are straightened out and the fuse needle is driven forcibly into the detonator. The resulting flash passes through the flash hole in the body and ignites the mealed powder in the powder shaft of the top ring. This ignites the train of powder contained in the circumscribing powder train. From the powder channel in the top ring a similar powder train in the lower ring is ignited through a connecting hollow black powder stick. From the second powder channel, the flash is transmitted to the powder magazine in the base of the time fuse,

through connecting sticks of black powder in the fuse body. The magazine connects with the powder pocket at the center of the base, from which the flash is transmitted to the powder tube in a shrapnel or to the corresponding "gaine" in the high-explosive shell, which, in turn, delivers to the main explosive charge of the projectile.

The passage of the initial flash from the detonator to the powder pocket in the base of the time fuse is varied in length by adjustment of the time ring, and the length of the powder train which has to be consumed before reaching the top of the powder tube or "gaine" controls the instant at which a shrapnel will "break" or a high-explosive shell will be shattered. The adjustment of the time ring simply shortens the passage by establishing short cuts between the powder channels or increasing the distance between points of communication.

Should, by any mischance, the time fuse element fail to work, the projectile will then break on coming in contact with a rigid object, through the action of the auxiliary detonating element of the device.

In the base of the mechanism is a second detonator which is held in place both by a stirrup similar to the one which holds the time pellet behind the cap and the body of the fuse and also by a coiled spring between the holder of the detonator fuse needle and the percussion pellet. On the projectile striking a firm object, the percussion pellet with its detonator is thrown violently forward against the detonator fuse needle and the resulting flash is transmitted immediately to the powder tube or to the "gaine," as the case may be,—thus avoiding the circumscribing powder trains through which the flash produced from the contact of the time detonator and the fuse needle must pass.

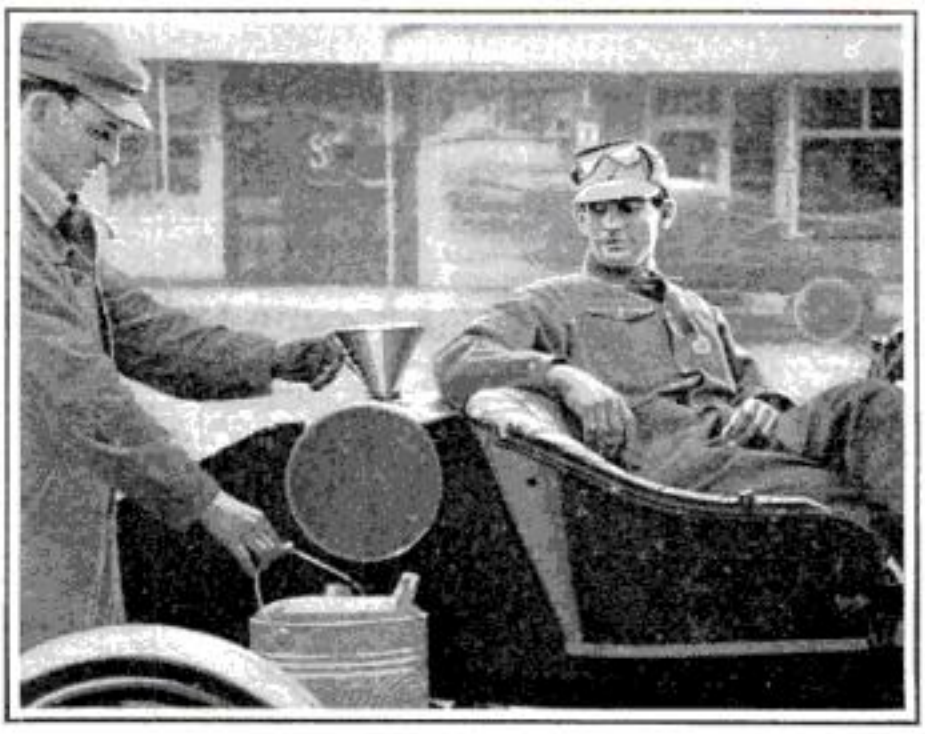


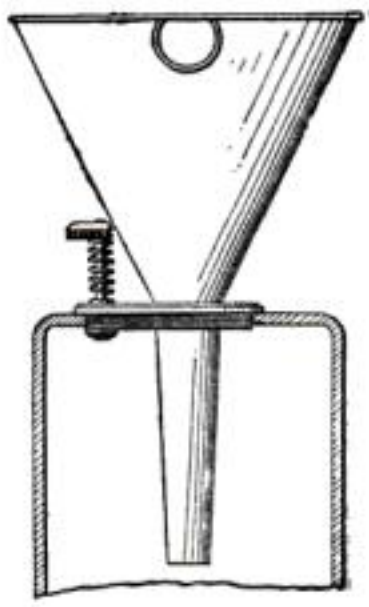
Shrapnel with its rain of balls, and high-explosive shells with their burst of jagged shell fragments

Destructive as is the time fuse when fitted to a projectile which leaves a gun, it is comparatively harmless under ordinary conditions, on account of the rigidity of the stirrup holding the time pellet and of the springs holding the percussion pellet.

Filling Up Your Automobile Tank Without Spilling the Gasoline

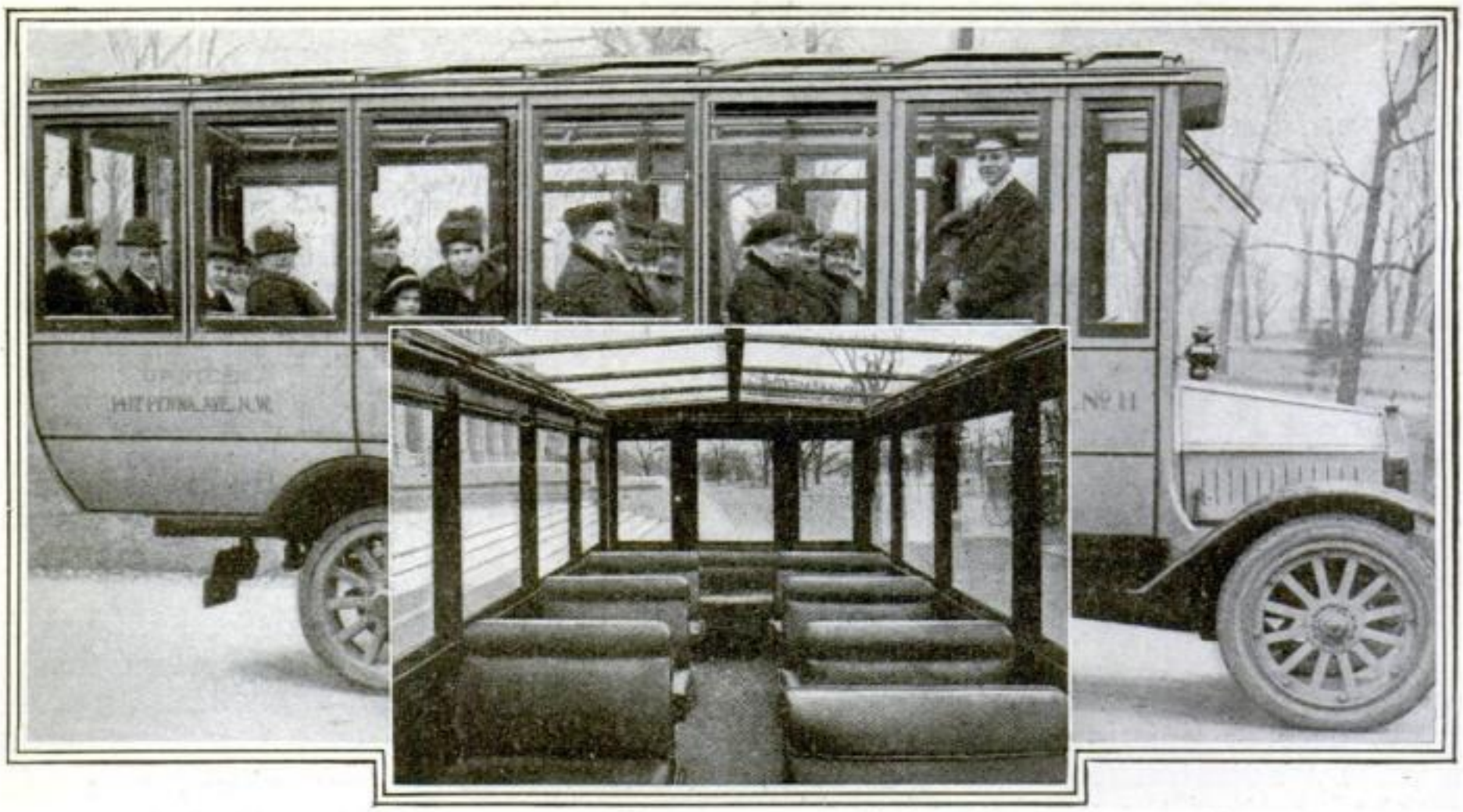
EVERY autoist will appreciate this funnel, invented by Walter W. Errington of Texas. It is an ordinary funnel soldered to a plug which fits snugly in the tank opening. The air valve, through which the air in the tank escapes when the gasoline is poured in is attached to this plug, the valve stem and spring serving as the funnel handle. When the gasoline reaches the mouth of the spout, you simply release your pressure on the spring to let it close the valve. Immediately the flow of "gas" into the tank is stopped because of the air pressure. So you fill up the funnel and then reopen the air valve. All this can be done in about twenty seconds.



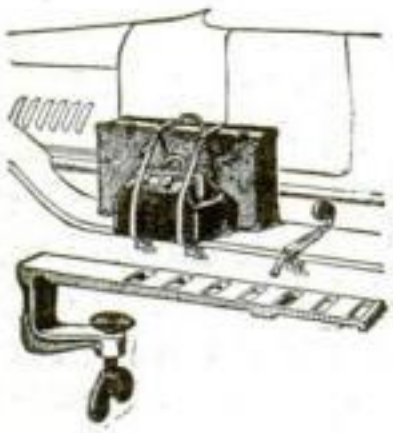


With this funnel the autoist can fill the tank of his automobile with gasoline in less than half a minute

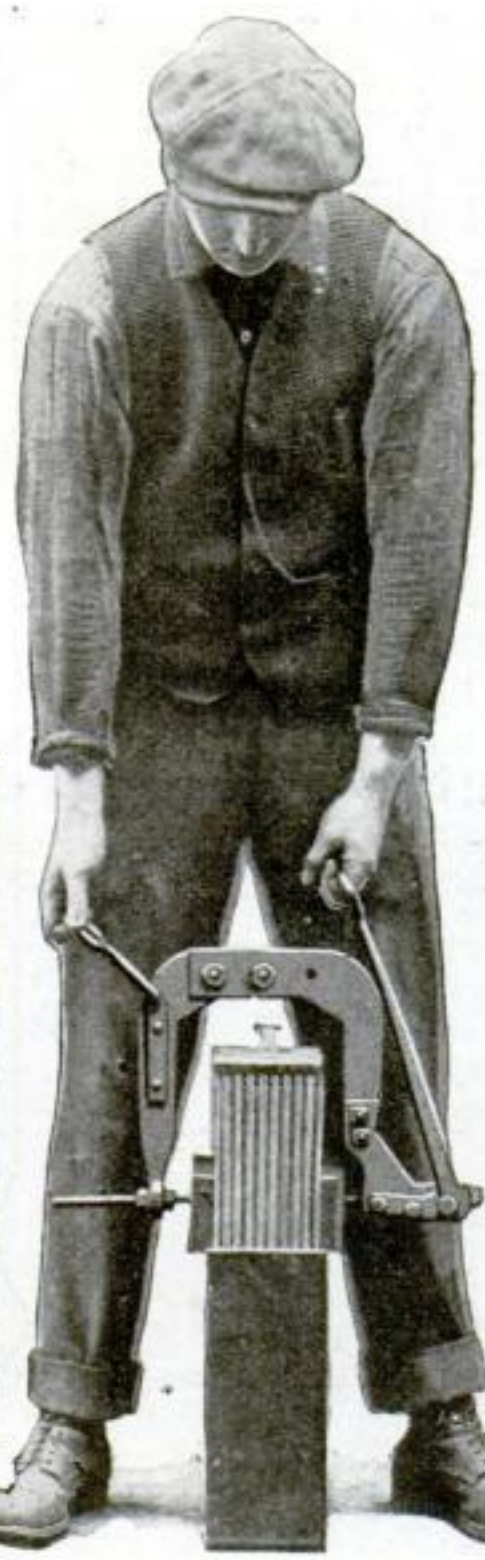
And Still the Inventors Continue to Provide Us



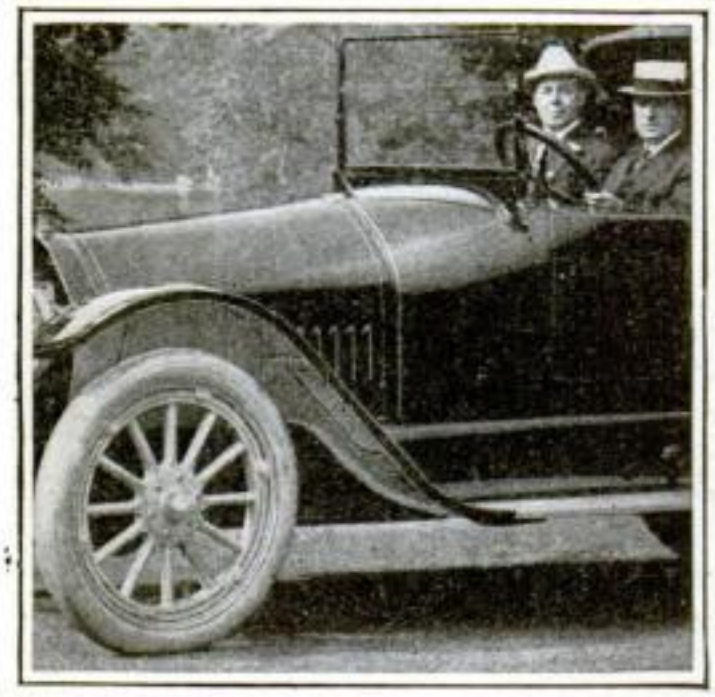
This ideal sight-seeing automobile is surrounded by glass, even at the top. City skyscrapers and country mountains can be seen with ease by every passenger



Two detachable strap-carriers which hold the luggage on the automobile running board



This bracket serves the double purpose of holding the license plate and locking the crank handle

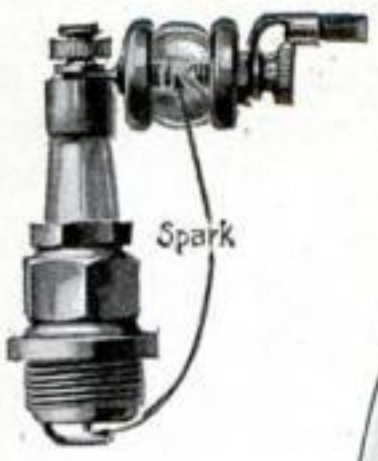


Dirt and grease splashed under your mud-guard can be very easily removed by detaching this lining and washing it

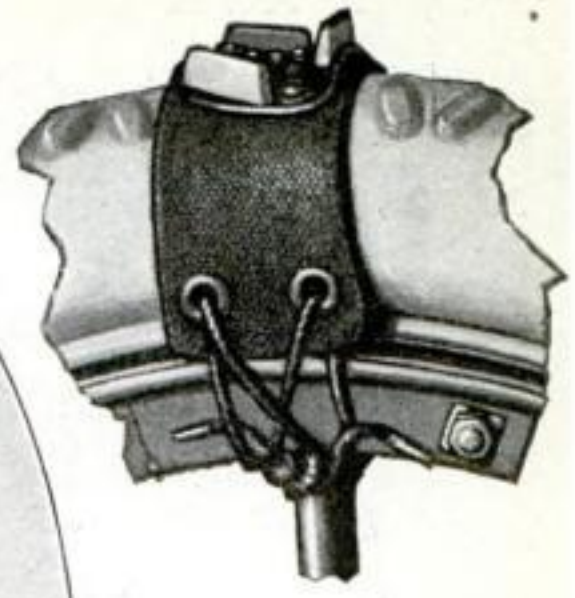
Gripping- and compressing-tongs for making battery-plate handling easy

A dividend-paying advertising attachment. It also prevents dust and mud from splashing into the faces of passers-by

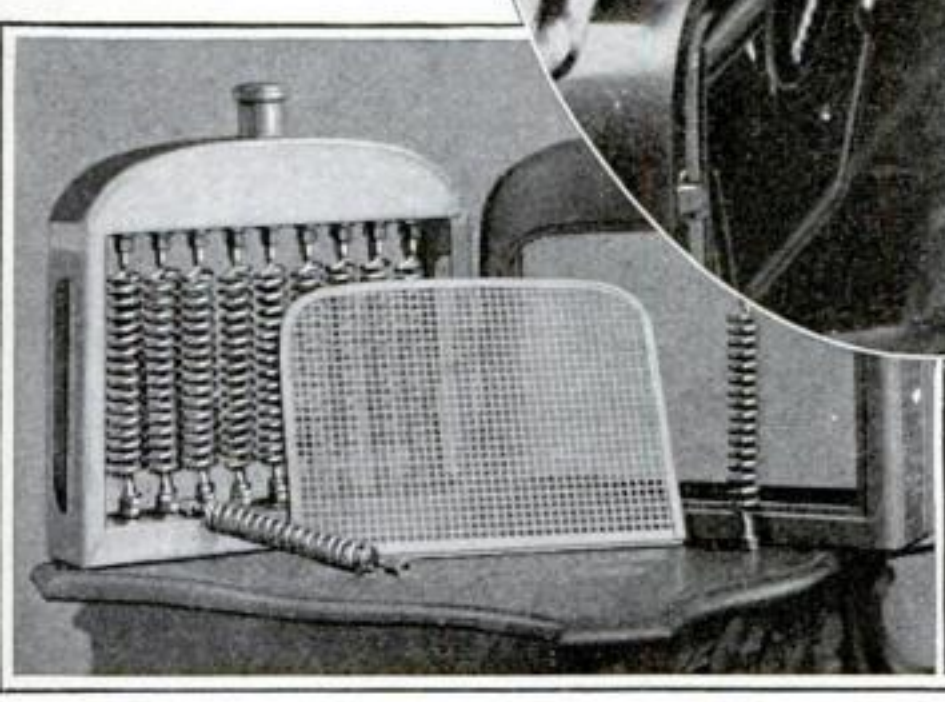
with Automobile Improvements and Accessories



An auxiliary spark chamber which intensifies a weak ignition by firing the cylinder spark on static electricity

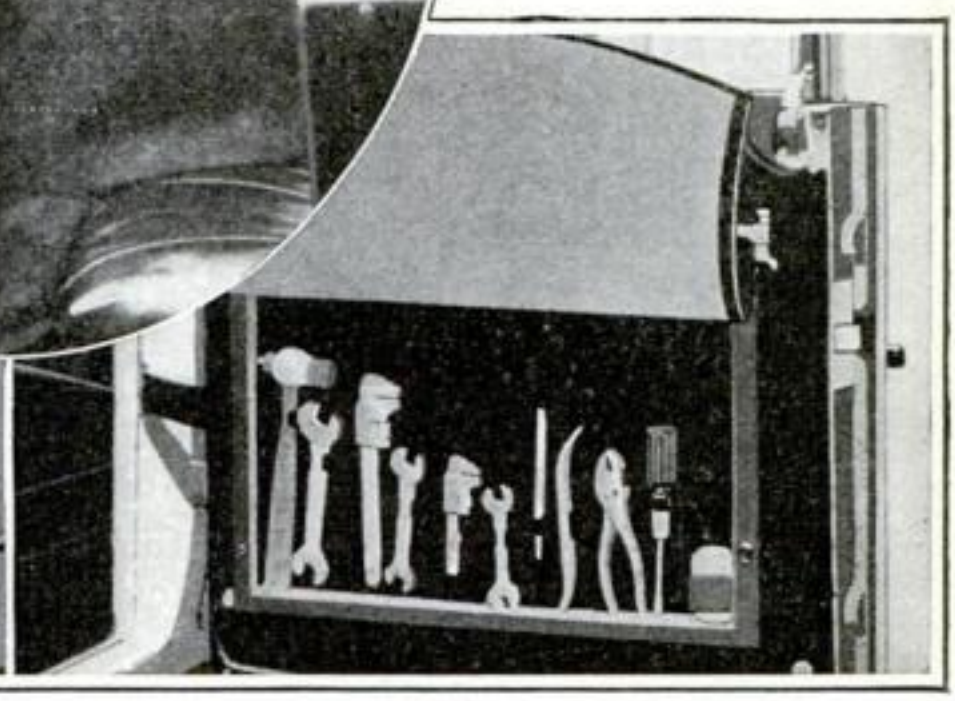


A veritable "traction-hook." The stubs will sink to solid ground and afford traction in the deepest mud

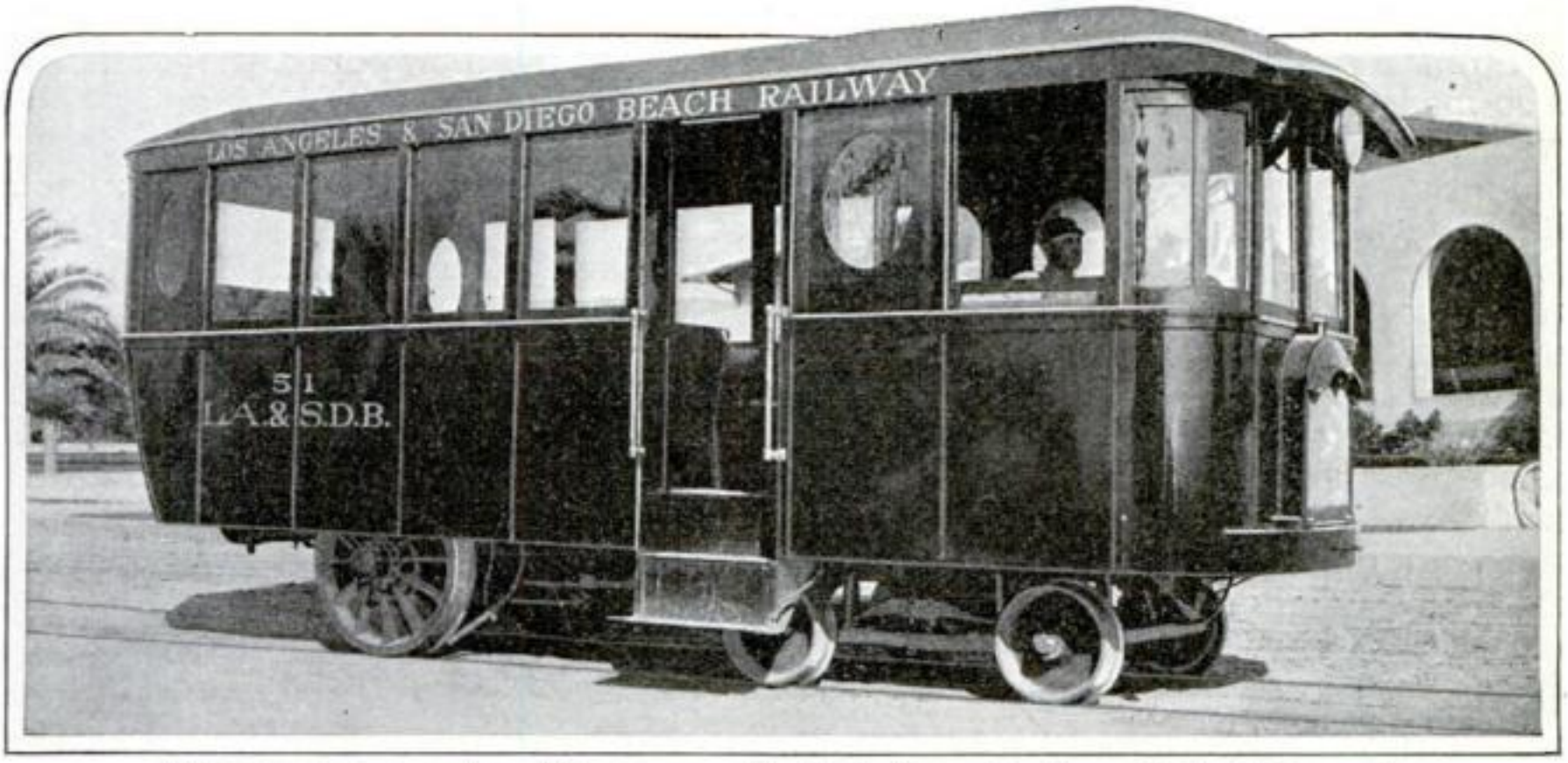


The hot water from the engine can be very effectively cooled by this radiator made of water-coils

Above: The steering wheel is pivoted at the upper section. You can swing it down and enter



A fully equipped tool cabinet built in the door near the driver's seat is always ready for an emergency



This overgrown automobile on car wheels is the salvation of short-line railroads. Gasoline will here do the work of steam at a fraction of the expense

The Misunderstood Shark

Under-sea photography is adding to our scant knowledge of these wolves of the deep

A shark weighing 800 pounds and more than twelve feet long, caught by Mrs. Otto Jaeger at Palm Beach. It was caught with a rod and reel but had to be shot with a heavy caliber rifle

WILL a shark attack a man? "Yes," say the landlubbers, some of whom saw sharks deliberately attack and kill bathers along the New Jersey coast last year. "No," indignantly retort the sea captains, fishermen and shark-wise scientists.

The truth is that only a few facts about sharks are well established, apart from the question of whether they do or do not kill human beings. For instance, there are so many different kinds of sharks that it would take this page, set in fine type, to list them. When it reaches a length of three feet the dog fish becomes a shark to most people. Yet the white or man-eating shark attains a length of forty feet: There are sand sharks, nurse sharks, blue sharks and others too numerous to mention. But the fact that the white shark has the designation "man-eating shark" is evidence enough that he is an eater of human flesh. His triangular teeth, his armor-like skin and his lightning speed under water make him a wolf of the deep. His home is in tropical waters, but he is an occasional visitor to the waters of Long Island—and without any invitation, too. The white shark has been blamed for the attacks off New Jersey

Sailors will tell you that sharks will eat anything that they are shy and cowardly; that they are inactive in the daytime and feed mostly at night; that the hungrier they are the more ferocious they become, attacking and killing other sharks, and that they are the swiftest swimmers of the deep

There seems to be some misunderstanding concerning the way in which sharks attack their victims. Some claim that they turn over as they attack, so as to bite more readily with their receding underjaw. Others claim that they attack head-on, swimming to their victim in a straight line. According to J. E. Williamson, whose work in photographing the shark under water for the motion-picture plays "Twenty Thousand Leagues under the Sea" and "The Submarine Eye" has been notably successful, the "head-on" description of attack is the correct one.

"I can prove by my pictures that a shark does not turn over to bite," states Mr. Williamson. "If a shark wants to pick up anything from the bottom of the sea he goes right down to it as a cat pounces on a bone and picks it up. A shark does not turn over to bite any more than any other fish does."

In photographing sharks with his submarine camera, Mr. Williamson used a steer as bait. The carcass floated on the surface of the water some ten feet from the camera. It did not take long for the

sharks to locate it. They approached cautiously at first and then attacked it, striking it with the force of a ram and tearing off huge pieces of flesh. Attached to the body of each shark, as the pictures show, were the usual pilot fish, clinging with the aid of sucker fins. As soon as a shark is dead the pilot fish attack it, eating their way through the dead body. One shark, Mr. Williamson observed, struck a projecting beam and was dazed momentarily. The instant the other sharks saw this they fell upon the unfortunate one and literally tore it to shreds.

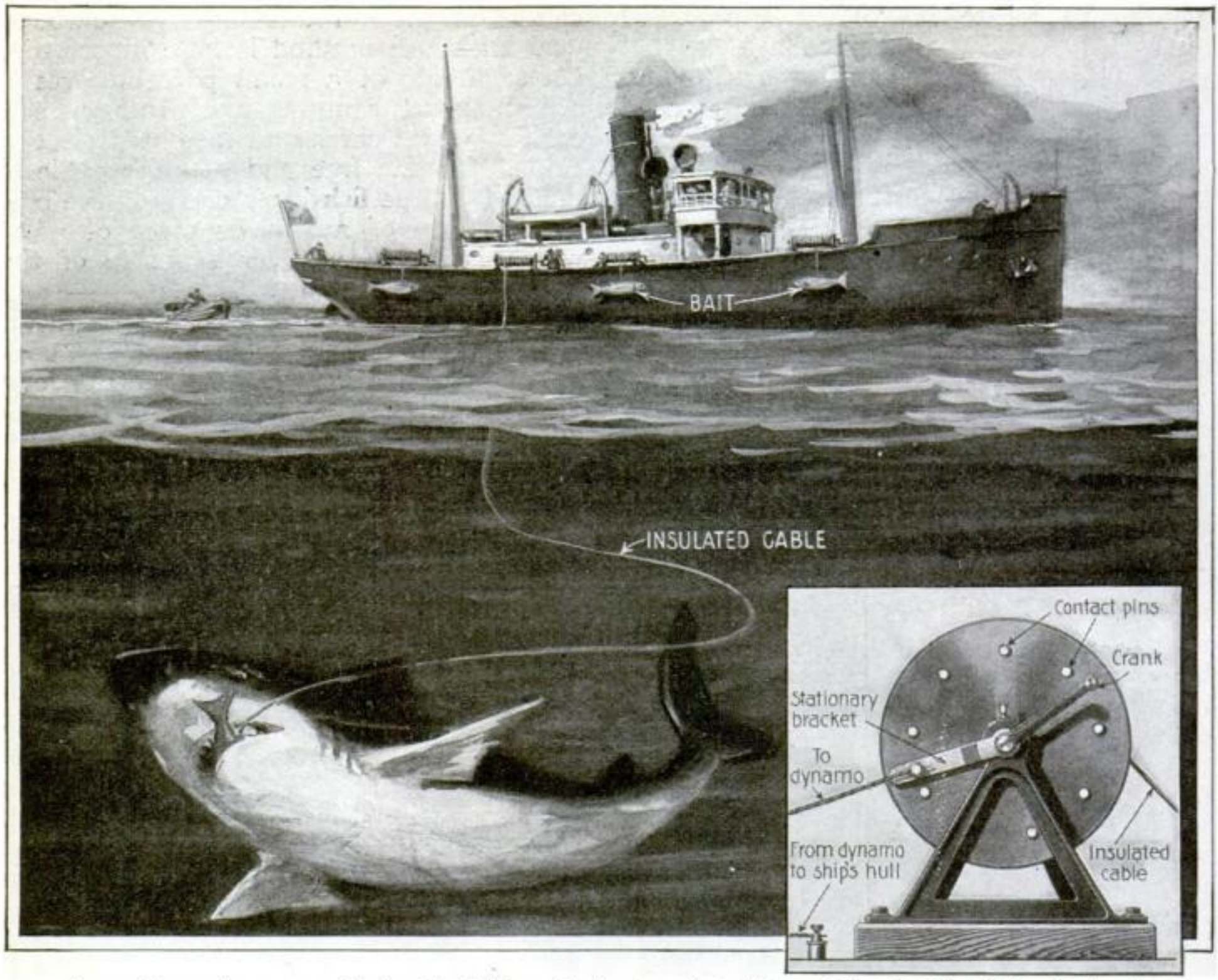
Ordinarily, sharks are easily caught with bait and hook, and frequently they become enmeshed in fishing nets. But no one has ever devised a scheme whereby they can be caught and killed in large numbers. One ingenious method is here illustrated. On each side of a small patroling vessel are mounted a number of rotary reels each of which carries an insulated electric cable. To the free end of each cable is secured a large fish hook carrying the bait in the form of a fish or piece of meat which is let down over the side of the ship almost to the water's level.

The reel drum has on one of its heads a number of contact pins which are connected with the insulated cable. As soon as the reel is turned slightly, one of these pins comes in contact with a stationary bracket connected with one pole of a dynamo supplying a current of 220 volts and five amperes, the other pole being con-

One of the scenes photographed under-sea by the Williamson Brothers for their thrilling film production, "The Submarine Eye." In this picture Mr. Williamson proves that a shark does not turn on its back to attack an enemy as is commonly supposed

Sharks are easily caught with bait and hook. Here is shown the type of giant hooks used

Notice the small pilot fish underneath the shark at the bottom of the picture. It clings to the shark by sucker fins and feeds on the body eventually



A vessel carrying a new device for killing sharks by electricity. The detail of the device by means of which the bait is charged is shown in the lower right-hand corner of the picture

nected with the metallic hull of the vessel and the water.

When a shark seizes the bait, he pulls on the cable, and the reel is rotated. The electric current then shoots from the dynamo through the cable, the hook, the shark's body, the water, and the ship's hull back to the dynamo. The electric shock contracts the shark's jaws around the hook like the jaws of a vise, so that escape is impossible. He is electrocuted almost instantly.

Co-operative Kitchens to Solve the "High Cost" Problems

THAT the cost of the primary necessities of life has increased to a point that causes hardship, privation and undernutrition among the unemployed or in large families striving to exist on a small income, is no doubt pitifully true. In the majority of cases, however, it is expensive tastes and pampered appetites which suffer most. Ignorance of how to spend money in order to get fullest food value and of how to prepare the food to the best advantage is also a contributory cause of hardship.

The food actually required for the body's needs costs very little. Enough pork and beans, bread and butter, milk and coffee, with the fuel to cook it, to amply nourish an adult for an entire day would cost only about twelve cents, according to expert dietitians. Numerous other inexpensive and healthful foods there are to add variety; but the problem is to govern the quantity and kinds of food by the needs of the individuals to be served and to prepare it appetizingly.

The solution seems to lie in the co-operative kitchen, in which Science writes the menus, consulting not the personal appetites of the patrons but their specific needs. The highest cost of meals for an entire day in such a kitchen should be not more than thirty cents for each individual, including the diagnosis.

Teaching the Proper Care of Forests by Object Lesson Models

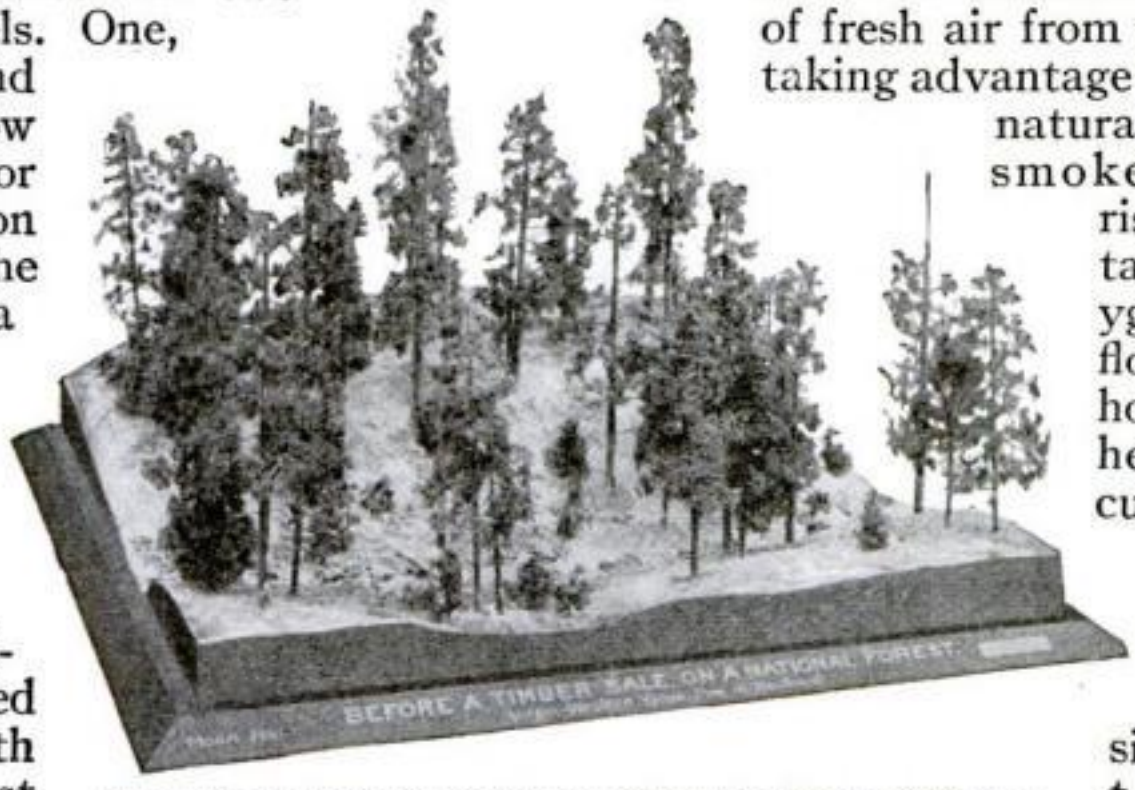
THE right and the wrong way to cut timber is shown by realistic models which the Forest Service has had prepared for exhibition purposes throughout the country. Three models are included in the series. The first shows a stand of one acre of virgin timber, an actual scene in one of the national forests that has been reproduced on a small scale with great accuracy both as to proportion and coloring.

The second of the series shows the same stand after a timber sale conducted in accordance with the regulations of the Forest Service. The matured trees have been felled and cut into lengths which have been arranged in systematic piles to facilitate their removal from the forest. All of the brush and small limbs, which, if left on the ground would constitute a fire hazard, have been arranged in compact piles in readiness to be burned under the watchful eyes of foresters.

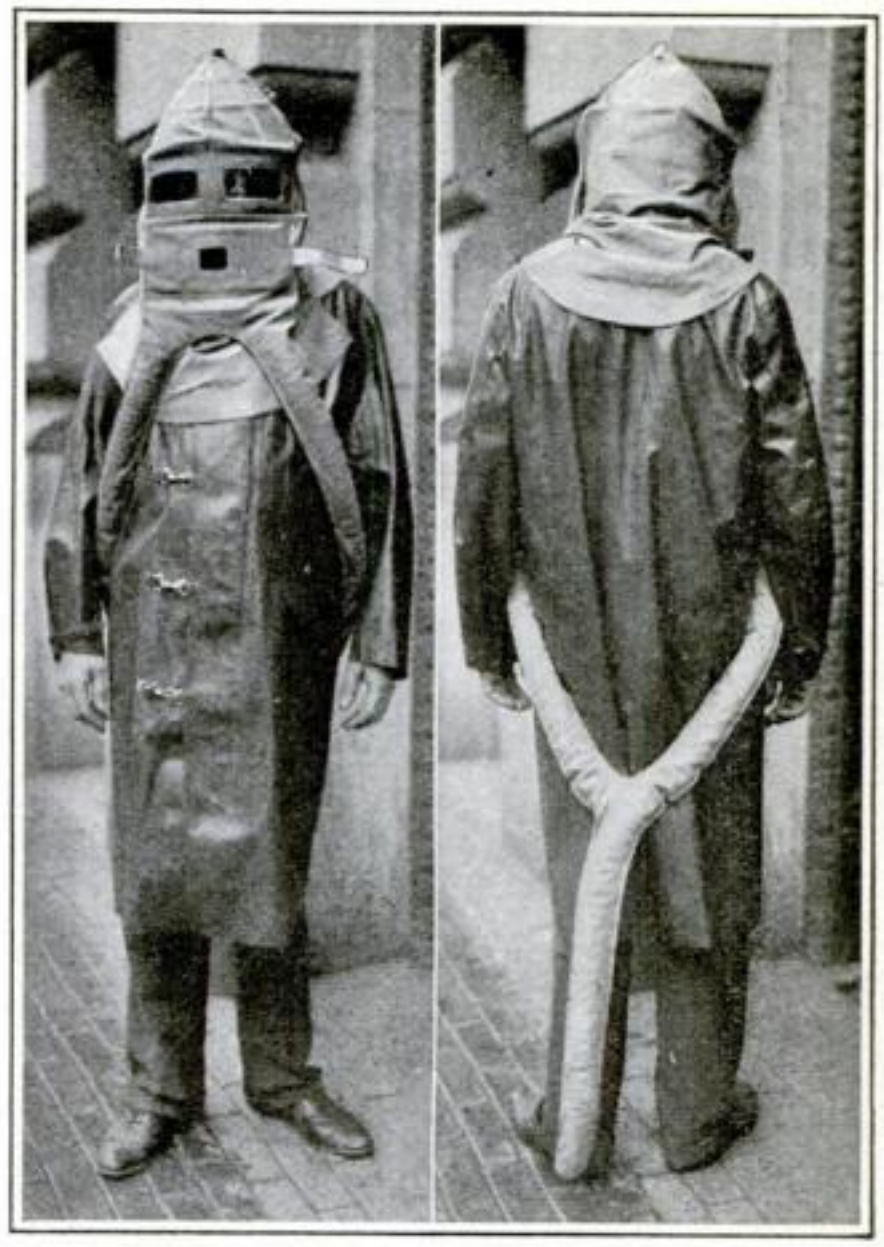
The third of the series shows an example of the wrong way to cut timber. Logs of various lengths are seen scattered about, no attempt having been made to arrange them in piles. Some of the trees felled have not been cut into lengths; many have been cut down without regard to size or maturity. All of the cut timber and the trunks of the standing trees are charted and the condition of the ground indicates that the forest has been burnt over, the inference being that careless methods on the part of those engaged in cutting out the timber have resulted in the spreading of a forest fire which might otherwise have been checked.

The Forest Service has two sets of these models. One, which shows a stand of Western yellow pine, is utilized for the western section of the country; the other, depicting a typical forest scene in the southern Appalachian region, for the eastern section.

The three models are exhibited in connection with lectures on forest preservation.



One of a series of models used by the United States Forest Service to show how timber should be cut



The helmet keeps the wearer alive by drawing its supply of fresh air from next to the floor

A New Helmet for Use in Smoke or Gas-Filled Chambers

THIS is not a gas mask such as is used in European trenches. It is a new helmet which the British Government has installed on five hundred battleships to be used below the decks when entering gas or smoke-filled compartments. It is also being introduced in America, in city fire departments.

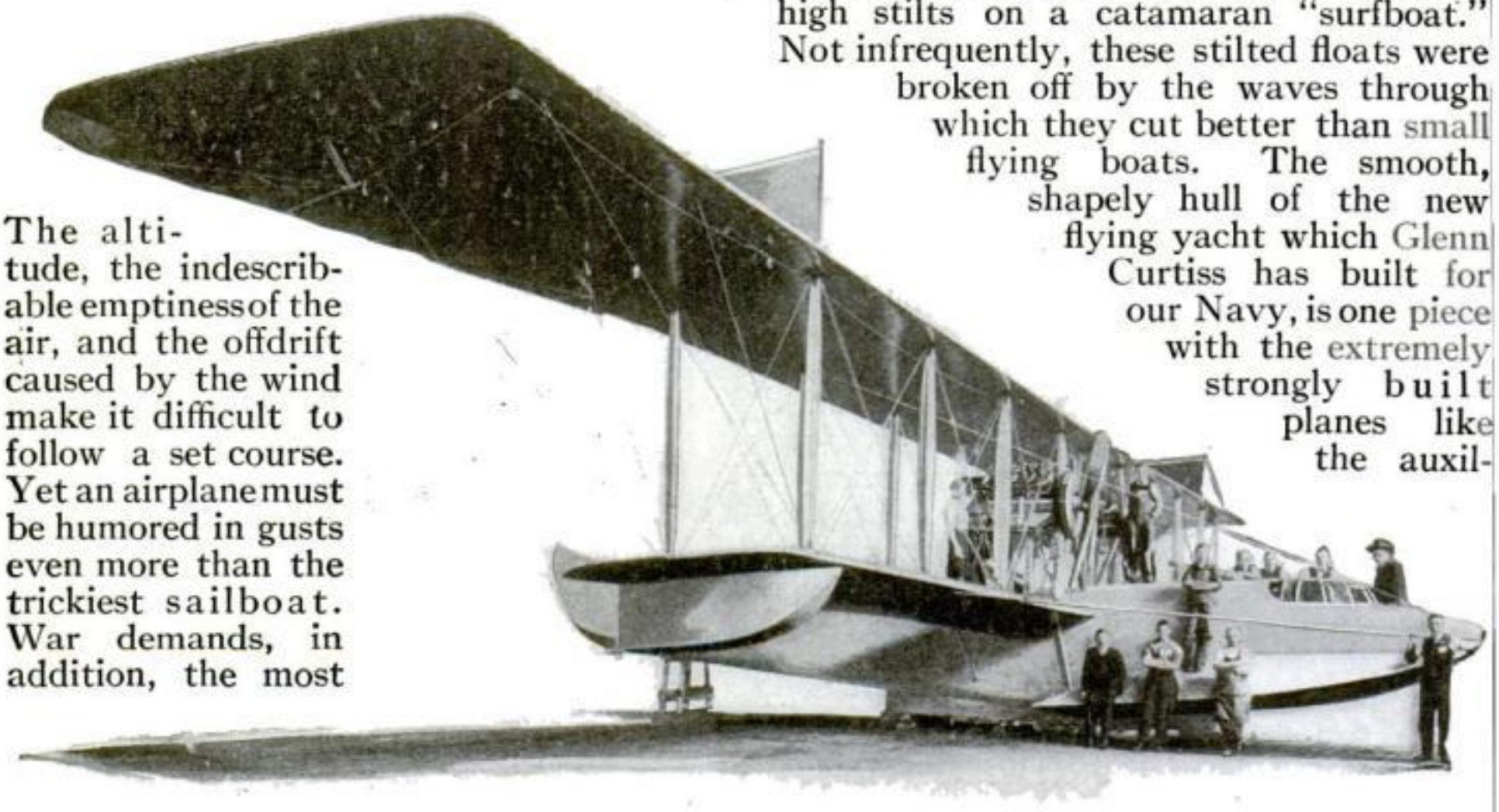
When used in smoke or gas-filled rooms this new helmet draws its supply of fresh air from next to the floor, taking advantage of the well known natural law that heat, smoke, fumes, etc., rise, leaving a certain amount of oxygen close to the floor. The trailing hose of the new helmet seeks that cushion of fresh air next to the floor. The helmet weighs only four pounds. One size is adjustable to fit a man, woman or child.

America's Biggest Flying Machine

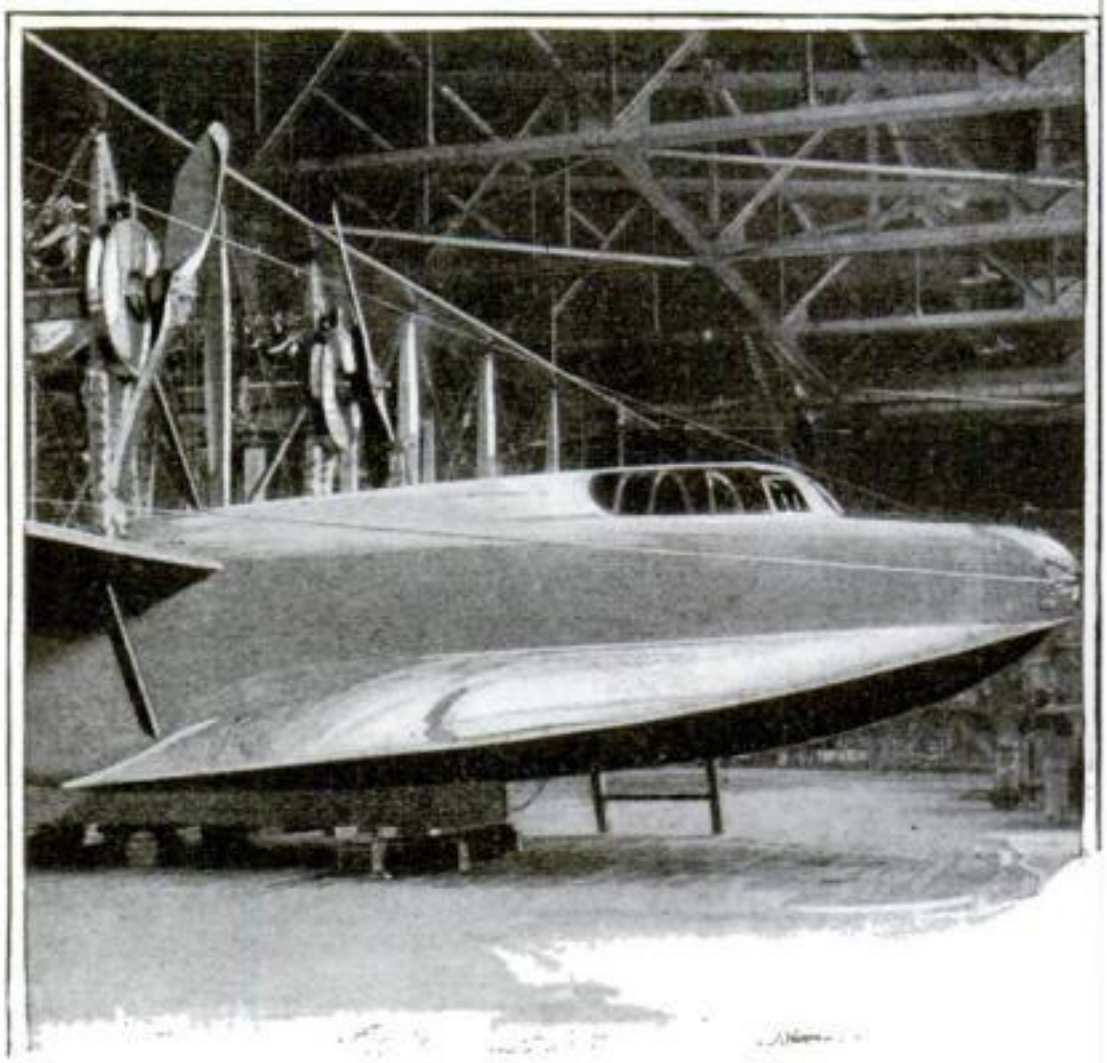
Glenn Curtiss builds a giant airplane for the Navy

By Carl Dientsbach

IN no craft are the drawbacks of small size so manifest as in aircraft. Flying in a disturbed atmosphere is never less severe than navigating an angry ocean. The altitude, the indescribable emptiness of the air, and the offdrift caused by the wind make it difficult to follow a set course. Yet an airplane must be humored in gusts even more than the trickiest sailboat. War demands, in addition, the most intricate observations; shells must be dodged, exact aim with bombs and machine guns taken, and rapid maneuvers carried out in aerial combat.



Increase the size of the airplane and at one stroke seemingly insurmountable difficulties are overcome. Exacting duties may be divided among a more numerous crew. Strong celluloid windows protect the men from storm and cold; no hampering clothing or goggles are required; there is space to move about; numerous instruments and conveniences can be provided and handled at ease. Airmen have to thank the ocean for all these blessings. No mere cockle shell of an airplane can ride the waves as a naval airplane must. The old "flying boat" had eventually not only to be vastly enlarged, but also completely decked over and turned into a true "whaleback" to become at least really seaworthy. In its new extreme size and shape it promises to supersede that homely compromise, the "seaplane," a moderately enlarged airplane mounted on high stilts on a catamaran "surfboat." Not infrequently, these stilted floats were broken off by the waves through which they cut better than small flying boats. The smooth, shapely hull of the new flying yacht which Glenn Curtiss has built for our Navy, is one piece with the extremely strongly built planes like the auxil-



The smooth, shapely hull of the new Curtis flying yacht is in one piece with extremely strong planes

iary floats on the wing tips, and promises to defy the ocean successfully.

The difficulty of making any large airplane relatively strong enough, although partly overcome because the unobstructed sea is an ideal starting and landing surface, still lingers in a certain relative deficiency in carrying capacity. On the other hand, there is a most welcome improvement in equipment and comfort which permits, among other things, a liberal utilization of electric lights.

Heavy loads, however, cannot be carried without materially cutting down the radius of action—loads such as heavy guns and ammunition. With motors of 400 aggregate horsepower, a span of 92 feet and a total weight of 7,000–8,000 pounds, this machine is expected to make from 55 to 85 miles an hour. So low a minimum speed is not objectionable on water. With only two men aboard, fuel for five hours might be carried.

All rudders and controls are worked by electricity, and controlled most of the time, gyroscopically.

Photos © Brown and Dawson

Above: The larvae of the Automeris Io, the moth shown at the left. Its brilliant stripes and branching spines are its protection

Teaching Children Natural History with Animal Pictures Made of Sand

THE approved method of teaching very young children is to disguise the instruction under the cloak of amusement. An interesting development in the carrying out of this idea is found in the sand pictures of Walter A. Ward, of New York city. Cardboards covered with colored pictures of animals are given to the children together with bottles containing the variously colored sand. The children paint the body of the animals with glue, and then carefully cover the colored portions of the animal bodies with the appropriate colors of sand.

In this interesting way, while the children seem to be merely amusing themselves they are gaining very definite instruction as to the names, coloring and physical characteristics of the different animals. Stories in connection with their habits and the countries where they may be found naturally accompany the pictures and enlarge the scope of the work. The rudiments of drawing and painting, as well as of Natural History, are indirectly taught in this way.

Sometimes an Object Is Beautiful Because It Is So Ugly

EVERYBODY is familiar with the extreme ugliness of the bulldog's face that makes the animal positively attractive; and everyone who has studied the moths is familiar with the marvelous hideousness —or beauty—of the larva of the *Automeris io*. The *Io* is found from Canada to Florida and westward and southward to Texas and Mexico. In the larval stage it feeds on the leaves of almost any tree or shrub.

For ages the enthusiastic lepidopterist has regarded it as a beautiful creature. The dainty green body with lateral stripes of pink and creamy white covered with clusters of branching spines forms an object to be admired—and respected too. It should be handled with care or painful consequences may result. Yet it is a curious fact that in spite of all the pains that Nature has taken to protect this beautiful creature from birds and other large enemies, she has left it open to attack from the tiny ichneumon wasp which drives its sting between the spines and there places a parasital egg. In this way multitudes of the larvae are destroyed.

How Would You Like to Hold a Chinese Printer's Job?

CHINESE characters do not express sounds although the pitch of the voice is significant. Their letters are ideographs, or writings of ideas or things. Hence the Chinese have no alphabet, strictly speaking.

For this reason the Chinese must employ an astounding number of characters. It takes about ten thousand characters to print a book in the Chinese language; yet sometimes an entire thought or a whole sentence is represented by one character!. The word "black" is one character, and so is "mother," "dead," "yes," "yellow," and a great many other words. With such a conglomeration, is it any wonder that the American printer wonders how it is possible to print anything in Chinese?

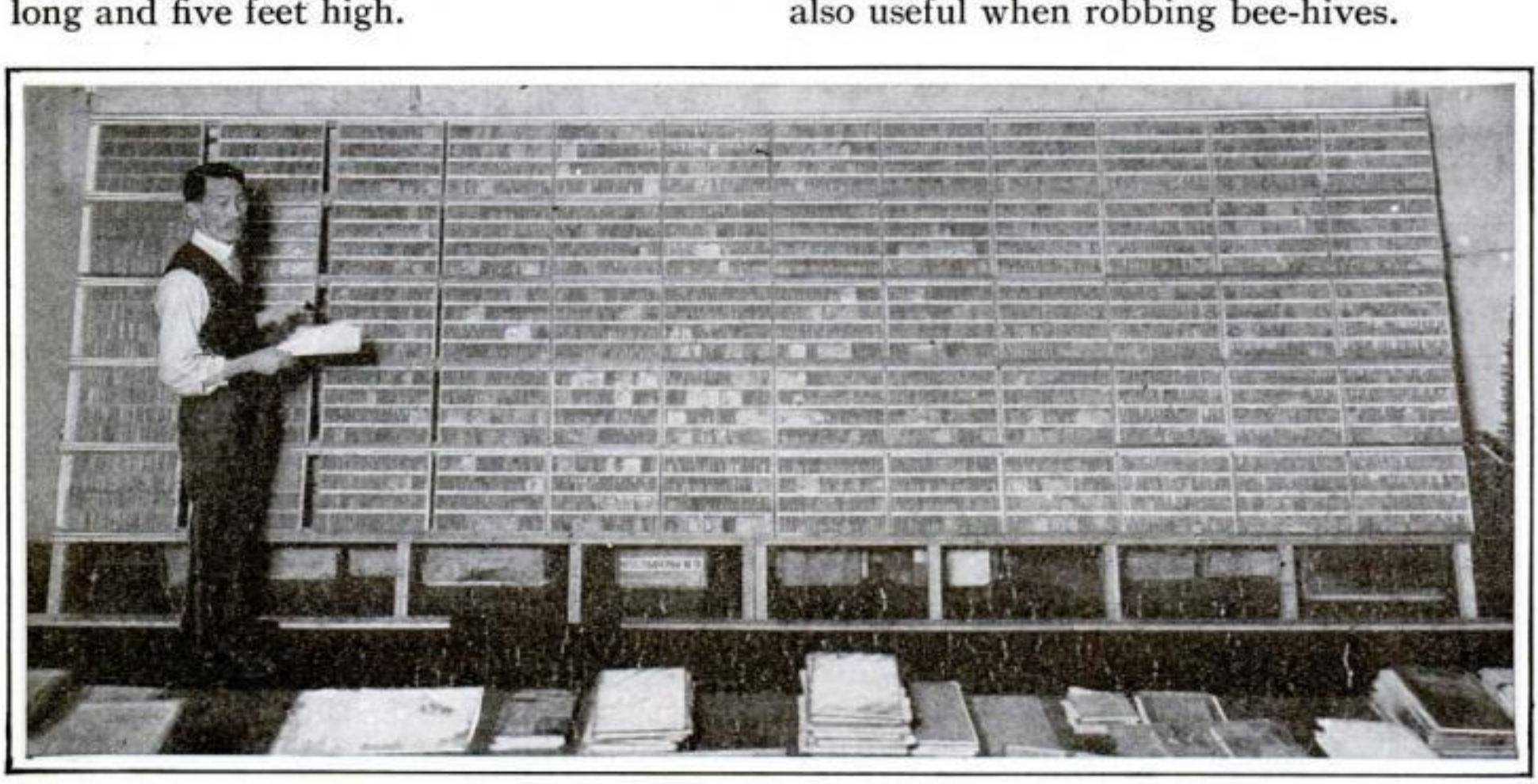
The illustration shows a frame containing one complete font (a font is an assortment of type of one size and style) of seven thousand Chinese characters. It required a month's time to arrange the type in place. The frame is sixteen feet long and five feet high.

A Wire Hood for Protection Against Bees or Mosquitoes

ALL too often, the best fishing and outing grounds are to be found where the mosquitoes and the wood pests are thickest. F. L. Rhodes, a fisherman of Michigan, at least found this the rule in his State. Notwithstanding the regular hoods of cloth mosquito-netting which he would use, the insects would finally get at him; the netting would catch in the bushes. He decided to devise a mosquito-proof hood which would overcome the difficulty.

This hood can safely be used through the thickest woods since neither the strong wire netting nor the heavy cloth beneath it can be torn by the bushes

Unlike cloth-net hoods, Rhodes' protector is made of fine brass wire which will not tear. A piece of non-breakable transparent mica enables the wearer to see, while a slide-covered mouth opening is provided to accommodate a pipe. To the ends of the wire netting two pieces of durable cloth are attached, the top cloth being used to secure the netting to the hat by means of a string. The bottom cloth of this hood is meant to be tucked under the coat. Such a hood is also useful when robbing bee-hives.

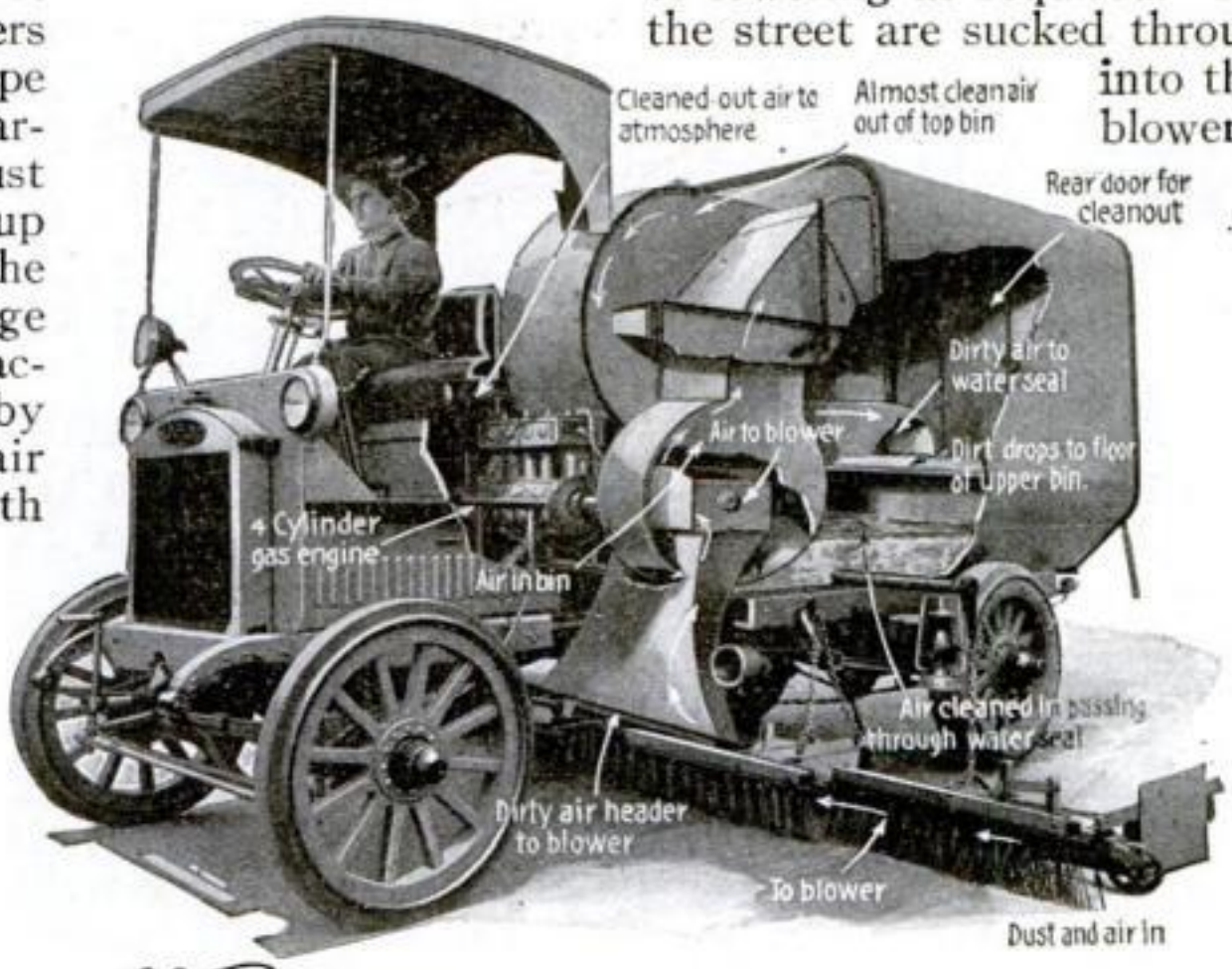


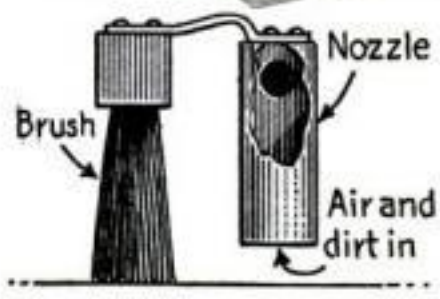
A frame of Chinese type containing one complete font of approximately seven thousand characters. The frame is sixteen feet long and five feet high. It took a month to distribute the type

A Street Cleaner Built Like a Carpet Sweeper

Cleaning two hundred thousand square yards of pavement in eight hours

THE motor-driven vacuum street cleaner shown in the accompanying illustration is built on exactly the same principle as that of the ordinary household carpet sweeper. It differs from others of a similar type in that every particle of the dust and dirt picked up is retained in the vehicle storage bin. This is accomplished by passing the air sucked up with the dust through a water seal. The passage of the dust-laden air through the seal filters it so that when expelled from the apparatus it is clean and pure just like the outer air after a rain storm.





The street-cleaner motor truck consists of a two-part bin, a blower, and a funnel shaped passageway through which dirt is sucked in. At left is shown a section of the brush and its nozzle

The vehicle is entirely self-contained. It sweeps the street, picks up the dust and dirt, deposits it automatically in its storage bin and can finally run to the point of disposal or have its load of sweepings transferred to other vehicles to conserve its own time for the cleaning operation.

While the sweeping and picking up of the load is entirely automatic, the method employed is very simple. The apparatus consists of a conventional motor truck chassis on which are mounted a two-part storage bin, a blower driven by a separate gasoline engine and a header or funnel-shaped passageway by means of which the dirt is sucked up off the ground and transferred to the blower from whence it is forced in the two-part bin.

The blower and its direct-connected gas engine are mounted transversely of the frame directly behind the driver's seat under a light metal cover. At the bottom the funnel-shaped header spreads out into a long suction box in close contact with the ground and supported on chains for raising or lowering as required. Air and dirt on the street are sucked through this header into the center of the blower as the latter is revolved. It is thrown out at the periphery of the blower into a rectangular pipe leading to the top of the storage bin. The latter is divided into two parts by a horizontal partition.

As the air enters the top portion it swirls around and deposits the greater portion of the dirt on the bottom of the upper compartment. The air is then drawn out and carried down into a small bottomless pan with its lower edges below the surface of several inches of water in the lower compartment. The partly-cleaned air has to pass down through the water and up on the outside of the pan before it is led to a pipe open to the atmosphere directly aft of the driver's seat on the side opposite the blower. The air is thus washed and freed of its dust before it is allowed to escape. The dirt collected is taken out through doors in each compartment at the rear.

This type of cleaner prevents the scattering of dust through the air and is cheaper and quicker than the old hand method or the broom and flushing method. It will clean two hundred thousand square yards of pavement in eight hours. Another advantage is that it does not make the streets slippery as does the water flushing.

Above: Grass growing on the wall paper of a New York city apartment. At right: How the salad is grown on a rug on the housetop

Growing Mustard and Water Cress on Blankets

PROFESSOR JASPER JEGGLES, an English botanist, advocates some quick methods of salad raising. "Mustard and cress," he says, "can be grown anywhere. All that is required is an old blanket hung over a line and well soaked with water. Sprinkle the mustard seed on one half of the blanket and the cress on the other and in two weeks time you will have a crop ready for the table."

In addition to growing salads on his blankets and flannels, Professor Jeggles is reported to have engaged in near-mortal combat with the janitor of the apartment house in which he lived. The professor was given to planting seeds on his wallpaper. He dampened the walls until the paper was pulpy and then sprinkled the seeds over it. In the steam-heated rooms his crops grew in double quick time. But the janitor stopped him.

"In England one big firm has manufactured umbrellas of a soft, absorbent material, so that seeds may be planted on them. Thus people walking along in the rain with their umbrellas covered with short, edible grass, present a refreshing appearance as of moving fields of living green, or floating emerald isles." The professor says this—not the editor of POPULAR SCIENCE MONTHLY. Is he jesting or is he merely practical?

Professor Jeggles is on his way to the Fiji Islands to study the flora and fauna there. He did not leave his address.

Children May Write On These Walls Without Fear of Punishment

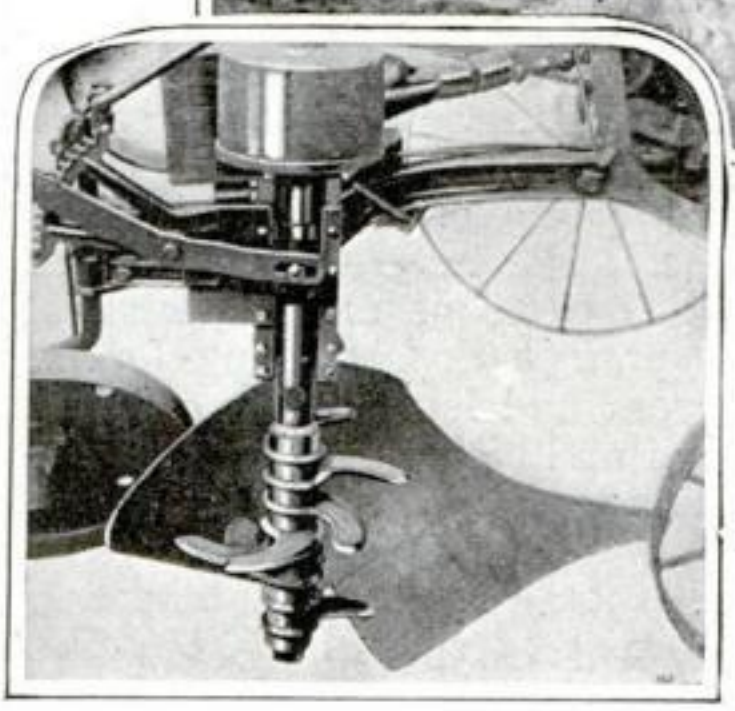
WHY would children rather write on immaculate walls than on writing paper? Because, first, their mothers caution them not to do it, and, second, because the walls are whiter and the writing looks better on them than it does on paper. But the time has come when the mother need fear for the white nursery walls no longer. They can, indeed, be changed from a source of irritation to educational purposes by means of a finish which makes them washable. In other words, all pencil, crayon and pen marks may be washed away. Consequently, the wall surface is as good a place for drawing pictures or working examples as the ordinary blackboard.

Although the finish is intended primarily for the walls of the nursery, it may be used in the kitchen, living room, or other part of the house where children are wont to try out their artistic ability on the walls. The finish may be in any one of a number of different shades.

With a finish that makes them washable, the walls of the nursery may be used like ordinary blackboards

Plowing and Pulverizing the Soil in One Operation

A ROTARY tiller which prepares a seed bed without the usual harrowing, disking and rolling operations has been invented by Guy E. Lincoln, a graduate of the Minnesota Agricultural College. It is somewhat similar to milling machines used in Europe, but it differs from them in that it does its work on a furrow turned with an ordinary sulky plow, while most of the foreign machines work on the soil just as it lies in the field.



The rotary tiller plows and pulverizes the soil, weeds and roots in one operation, eliminating harrowing, disking and rolling

The steel rotor tooth which is set to the right of the share and mold-board. It is geared to the shaft of a gasoline motor

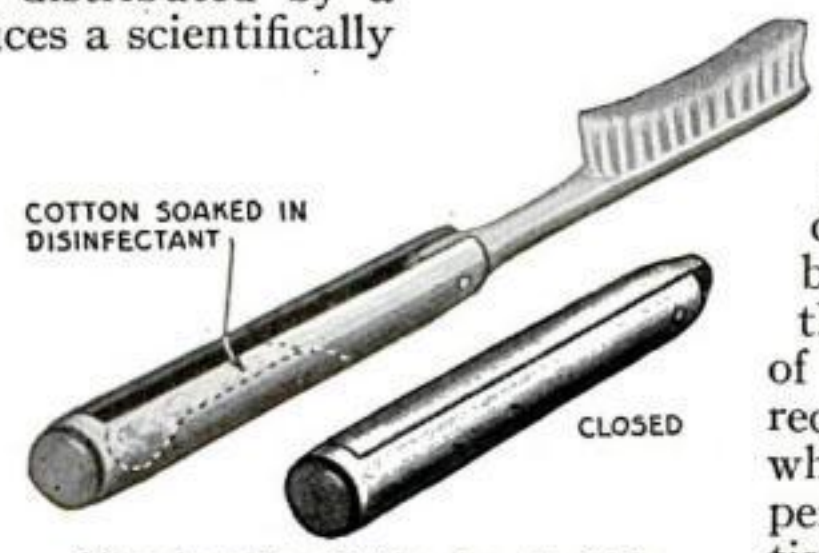
The tiller attachment consists of a steel rotor tooth set to the right of the share and mold-board. The rotor is geared at the top to the shaft of a small gasoline motor which whirls it at the rate of five hundred revolutions a minute. Thus the teeth of the rotor shred and tear the weeds, grass, roots, fertilizer and soil into a finely pulverized mass, making a mellow seed bed for the sowing of any crop. For use with the tractor the tiller attachment can be run by the tractor power.

The modern farmer has come to realize that the fertility of the soil depends upon the distribution of a goodly amount of humus (rotted vegetable matter) throughout the entire seed bed. Formerly this humus, as surface litter, was raked up and burned. Today it is returned to the soil to help feed the coming crop. When it is cut up, pulverized and distributed by a milling machine it produces a scientifically perfect seed bed.

There is undoubtedly a large place for the rotary tiller in the agricultural industry if it will do work equivalent to that of harrows and disks at a cost not much in excess of that incurred by horse-drawn implements. The principal drawback to tilling and milling machines has been the expense involved in their operation and breakages when encountering stones and other obstructions. The tiller described will only have to deal with stones which pass over the mold-board—an important fact in its favor. On the other hand, there would seem to be a waste of power in raising the furrow of soil several inches in the air in order to mill it. Some tillers work on the soil without raising it at all.

A Water-Tight Holder and Sterilizer for the Toothbrush

THE toothbrush illustrated is made with a folding handle, somewhat like that of a familiar type of pocket comb. But the toothbrush handle does more than fold over the bristles of the brush. It forms a receptacle for a disinfectant which will keep the brush perfectly sterilized and antiseptically clean until it is ready for use again. When the brush is clamped in its hollow handle it may be carried in the pocket, if necessary, in perfect safety, without danger of soiling or dampening the pocket.



The handle of the brush folds over the bristles and keeps it germ-proof with disinfectant

A Two-Million-Dollar Hospital Ship for Our Navy

PLANS for a hospital ship for the United States Navy have been completed by the naval constructors and officials of the Bureau of Medicine and Surgery, and work on the new ship, which will be a model of its kind, will soon begin at the Philadelphia Navy Yard. Congress has allowed $2,350,000 for its construction. Although the exact dimensions of the ship have not been determined, it is known that she is to use oil as fuel and that a special gyroscopic engine will be installed, to reduce pitch and roll to a minimum.

The ship will be equipped with the best surgical instruments and paraphernalia known to medical science. The several hospital departments will consist of an operating room, the out-patient department, dental operating room and laboratory, X-ray room, chemical and biological laboratory, several wards for the treatment of acute and venereal diseases, and a contagious disease compartment. There will be the usual wards and special accessory rooms for linen, wash rooms, pantries and kitchens. The main operating room will be located amidships, extending the height of two decks and provided with every lighting facility. Special rooms for the examination of eye, ear, nose, throat and kindred ailments will be provided in the out-patient department, where patients may receive the most expert care.

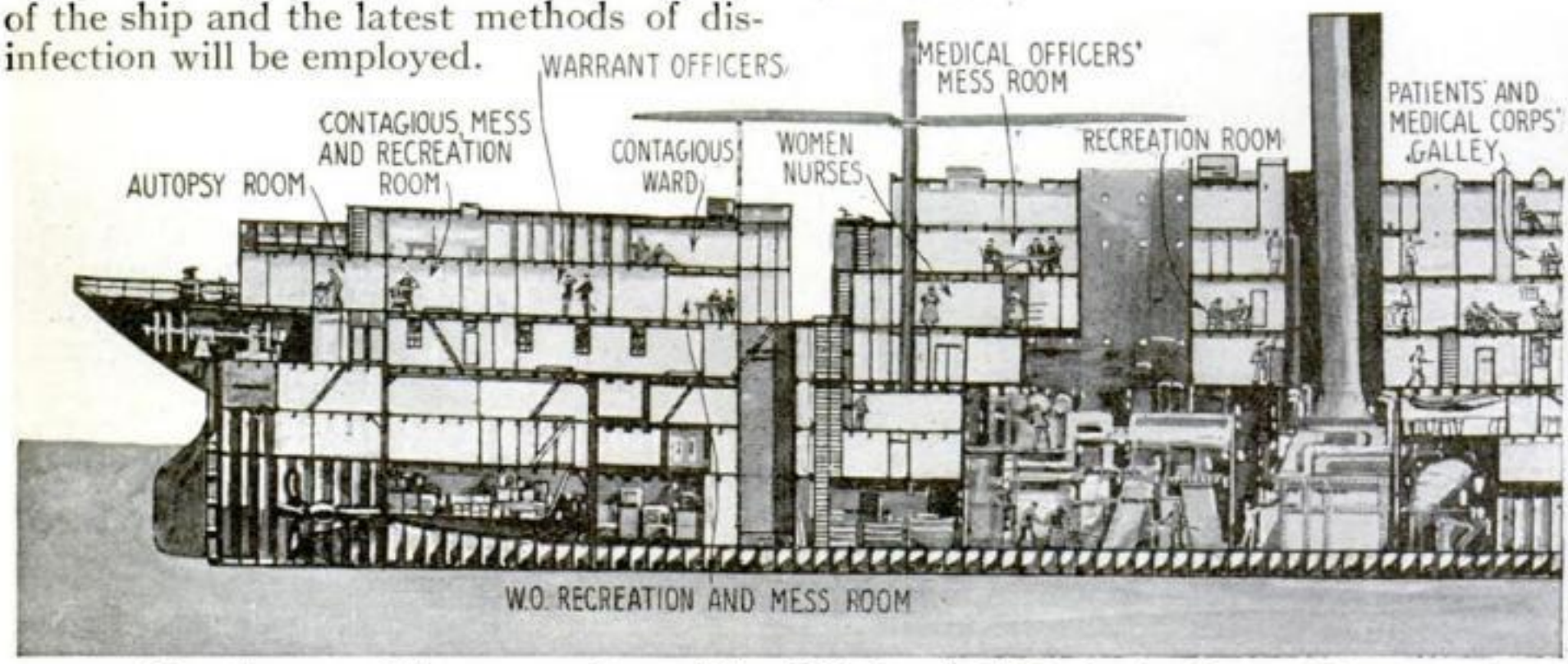
One of the important features of the proposed ship is the contagious disease compartment. This will be so designed as to be completely separated from the remainder of the ship and the latest methods of disinfection will be employed.

Lo, the Soya Bean! A Substitute for Meat, Fish and Fats

WITH all due respect to Western civilization and progress, we must nevertheless yield the palm to China for the production of the soya bean, a vegetable so full of promising possibilities that agricultural experimental stations all over the United States are concentrating attention upon it.

Milk from soya beans is no longer an experiment but has become a marketable commodity. It is sold in cans as a powder or in liquid form. As a substitute for meat and fish the experimenters say all that is required is the co-operation of good cooks to devise sufficient variety in preparation of the beans. The oil is considered of especial value. It may be used as a substitute for linseed oil or may be hardened into an edible fat suitable for cooking or even for table use. The pulp, or what is left over after the oil has been extracted, is conceded to be a valuable cattle food.

The only difficulty encountered thus far in the experiments with the soya bean has been in finding a suitable solvent to dissolve out any oil that may be left in the meal before the left-over portion is consigned to the cattle. Naphtha has been found to be good, but unless care is taken to remove all trace of it from the meal the new fodder loses its value as a cattle food, for the cattle refuse it on account of the smell. Another chemical which has been found to answer the purpose is try-chlorethylene. It is not offensive in odor nor poisonous. Yet a dangerous reaction has at times occurred when it has been used as a solvent.



How the space of the proposed two million-dollar hospital ship for the Navy will be apportioned. The best surgical instruments and equipment known to medical sicence, as well as the latest

The Mysterious Ice Mines of the United States

THERE are several caves in the United States where Nature seems to have become confused as to the seasons. During the late spring and summer ice forms and a freezing temperature prevails, but as winter comes on the interior of the caves becomes milder, the ice gradually melts and a kind of subdued summer sets in underground.

One of these peculiar caves is to be found at Coudersport, Pa., and one at Decorah, Iowa. The superstitious among the residents of those localities give the caves a wide berth and look with suspicion upon any one daring enough to attempt to investigate them.

Edwin S. Balch, of Philadelphia, who has made a study of the subterranean ice mines, as they are called, states that according to the theory evolved by investigators the formation of the caverns is such that the cold air of winter does not penetrate and settle in them until late in the spring at the time when the water from spring thaws is seeping through the walls and roof. This water meeting the cold air freezes and stays frozen all summer until, as the fall season approaches, the warm summer air at last finds its way into the cave and melts the ice.

When the snow is flying above and ice-skating is the amusement of the moment the summer air is at work in the cave and still water bathing might be indulged in by the residents of the community if the environment were right and if they dared. By the time this summer air begins to lose its heat it is spring again above ground.

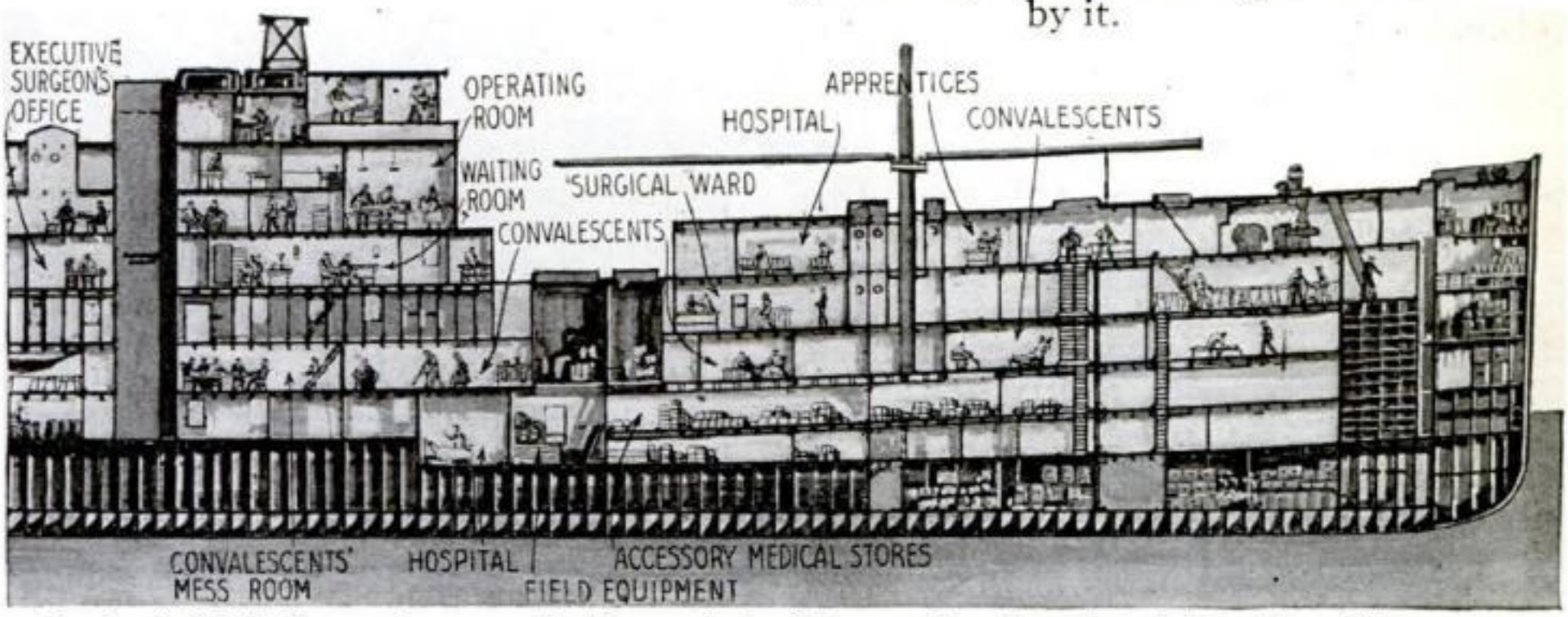
Poison Ivy: How to Kill It and Cure a Case of Inflammation

THE cheapest and most effective method of eliminating poison ivy, according to experts of the Department of Agriculture, is the simple one of rooting up the plants and destroying them. If the poison ivy is in large fields it may be necessary to plow and cultivate the land. Ivy on large trees, stone walls and buildings can be killed by arsenate of soda, at the rate of two pounds to ten gallons of water. Two or three applications are sufficient.

The fall of the year is the safest time to handle poison ivy, because at that time the sap and pollen are out of the plant. With the exercise of due care, the use of overalls and gauntleted gloves will enable most individuals to deal with the plant without danger. A further protection is to grease the hands with lard and after the plants have been handled to wash off the hands with strongly alkaline soap.

Minute amounts of a nonvolatile oil in poison ivy is what makes it cause extensive inflammation. Alcohol or a solution of sugar of lead will remove this oil; it is insoluble in water. In cases of poisoning, one of the most effective methods is to cleanse the inflamed surface repeatedly with alcohol, or with a saturated solution of sugar of lead in alcohol, using a fresh bit of lint or absorbent cotton each time to prevent the spread of the irritant. Covering the inflamed parts with lint or absorbent cotton kept constantly moist with limewater or with a saturated solution of bicarbonate of soda will afford relief.

It is a curious fact that many people are so constituted as to be able to handle poison ivy without being at all affected by it.

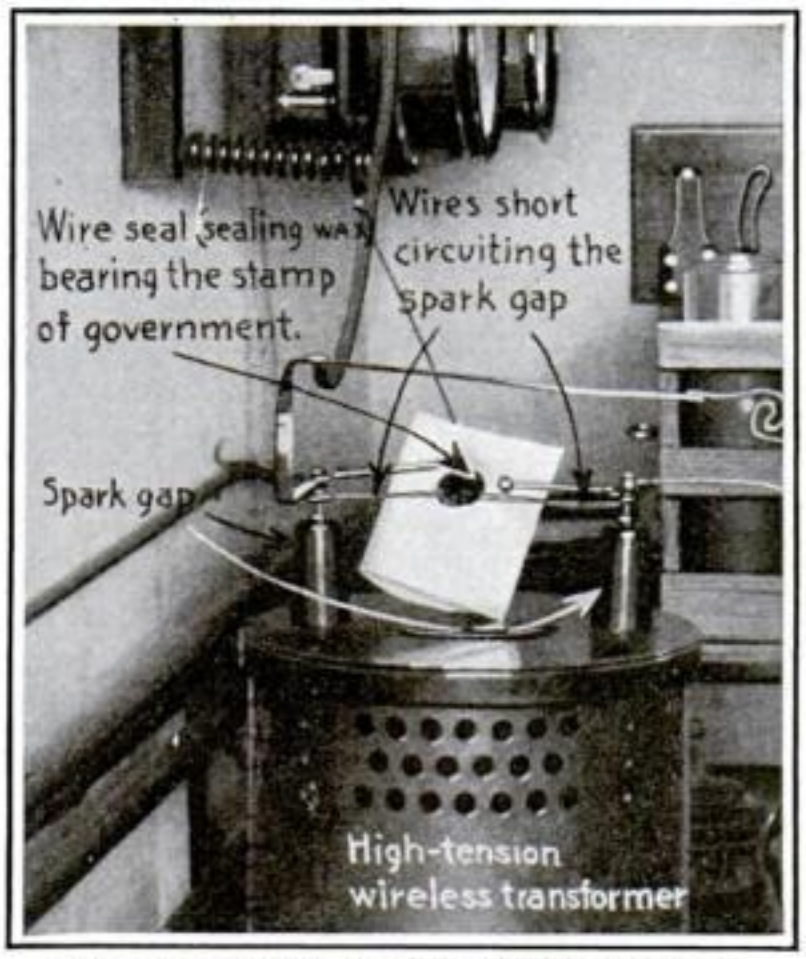


methods of disinfection and communication control will be employed on board the ship. The main operating room will be located amidships and will extend the height of two decks

How the Government Seals Unofficial Wireless Stations

AMATEUR and commercial stations alike have been ordered closed. The Government cannot afford to take any chances of military information leaking through to the enemy. All aerials have been dismantled, and the instruments stored away. In the very powerful wireless stations, the further precaution has been taken of sealing the apparatus electrically.

The manner of sealing such a station is well illustrated in the accompanying photograph of New York city's most powerful commercial plant. The transformer shown in the foreground was used to convert the low-potential alternating current, that is ordinarily used for light and power purposes, into a current of millions of volts in pressure, such as would be required for sending wireless signals.



A heavy wire short-circuits the high-potential sending transformer. If an attempt should be made to operate the station, the transformer would burn up

The Government's agents have simply wrapped a heavy copper wire around the transformer terminals, and have secured the wire ends with sealing wax on which is stamped the great seal of the United States of America. It is impossible to remove this wire without breaking the seal—and taking the consequences in imprisonment.

Teaching the Blind How to Write on Straight Lines

THE December issue of the POPULAR SCIENCE MONTHLY contained an article on an instrument invented to aid the blind in writing. This was the writing tablet invented by the French scientist Dr. Emile Javal. His tablet consists of a fixed elbow rest in which the writing arm swings across the paper. The line of writing is thus made comparatively straight, while the lines are spaced by virtue of an evenly notched rack which allows the tablet to be moved away from the elbow rest by the distance of one notch.

An improvement on this tablet has been developed by Arthur E. Tremaine, of Boston. By using a straight edge and a brass wire placed three-quarters of an inch above it across the paper, the sightless writer is able to keep the size of his letters uniform. Moreover, by eliminating the elbow-pivot principle, each line will be straight and not curved in the arc of a circle. Ink as well as pencil can be used since neither the beveled straight-edge nor the wire quite touches the paper surface. The straight-edge can be lowered line by line down the paper and evenly spaced by means of notches at the side. In this way a perfectly neat appearance is given to the written page.

As the blind man writes, his letters are kept uniform in size by the straight-edge below the pencil-point and the wire above it

A Torpedo-Proof Ship With Six Hulls

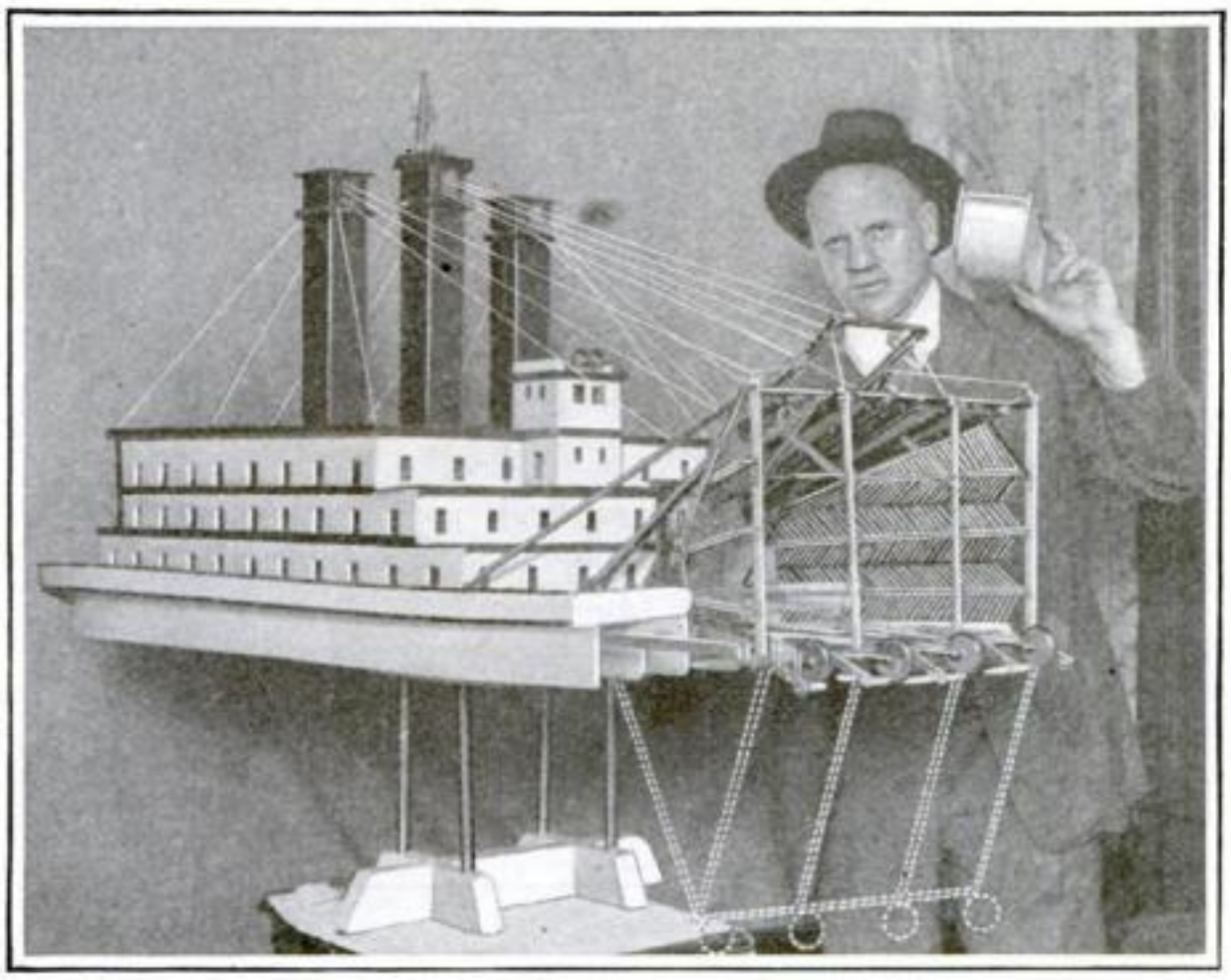
It is to solve the food problem by scooping up the fish from the sea

THE one great aim of Germany is to cut off America from her Allies, preventing our giving them military assistance and our supplying them with food. With his radically new inventions, Nels A. Lybeck, of New York, a seaman of many years' experience, hopes to thwart Germany in both of these aims.

Lybeck's invention of a multiple-hull ship utilizes a sailing principle never before used on any ocean-going ship. Six hulls twelve feet wide, separated by twelve feet of distance, support the rectangular decks of the ship. The hulls are slightly tunnel-shaped at the bottom, and when they speed over the sea, the water is packed in these tunnels,—they rise upward and slide through the water. This novel construction has still another virtue. The largest waves cannot roll this ship. The row of hulls makes the ship act just like a huge flat-bottom scow, longer and wider than the breadth of the largest wave. The boat virtually rides on the tops of the waves, rolling but slightly even in the most violent seas.

But what has this to do with submarines, you ask? Just this: With a rectangular, non-rolling ship it is possible to protect it from submarines by means of torpedo-proof shields. Where V-bow boats would violently pitch when speeding on the high seas, and thereby strain their nets until they snapped off from their supports, this ship would carry a continuous, submerged steel wall on each side which would have to resist only the slight traveling strains caused by the water's friction. At bow and stern, she could rig herself out with strong steel gratings, and thus defy the biggest enemy torpedo afloat.

It was not long after perfecting his submarine-proof ocean freighter that Lybeck further developed this scheme into his solution of the food problem. There are sufficient fish scattered in the ocean to continuously and completely supply the Allies with food many times over. Witness his truly twentieth century method:



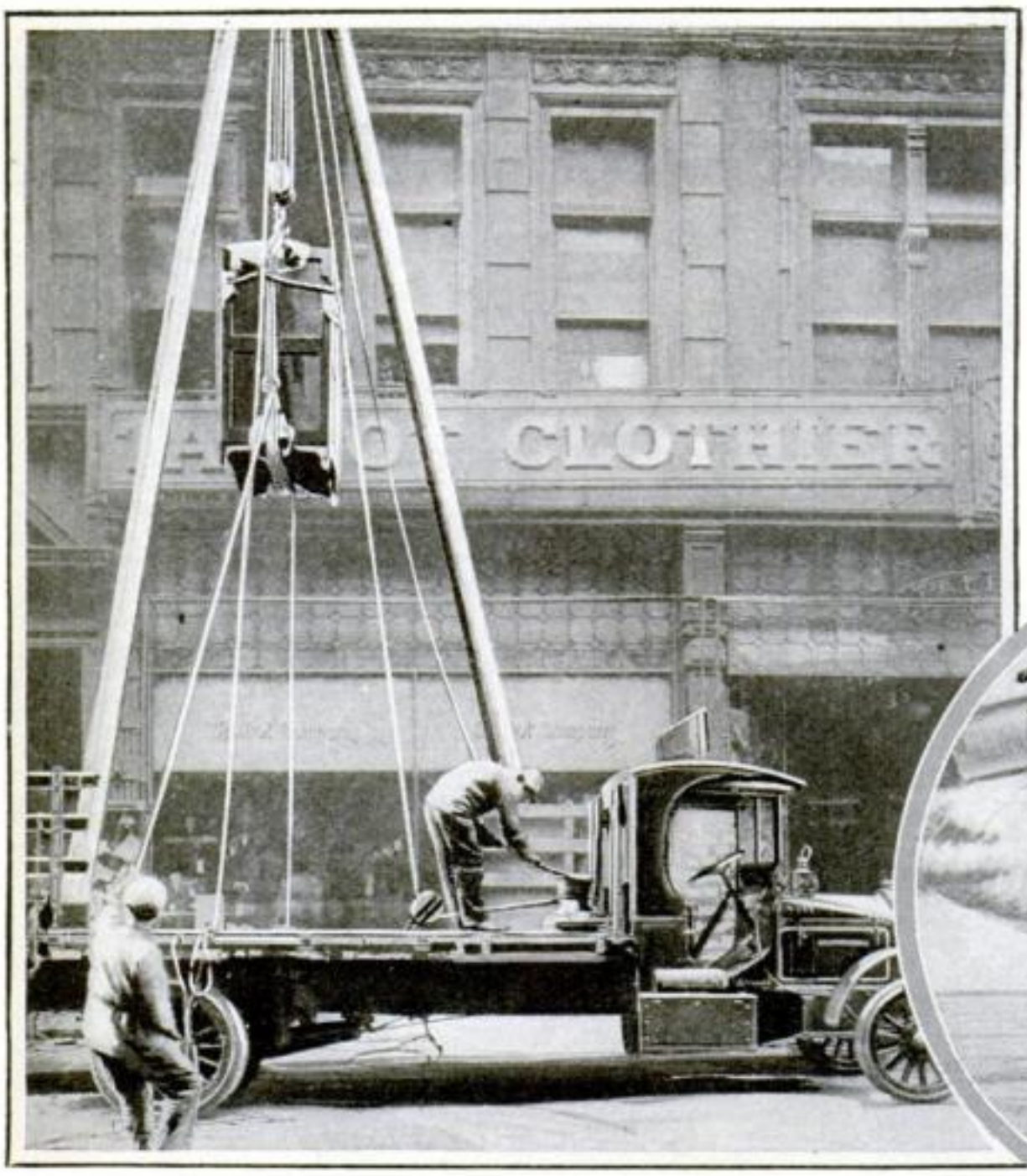
The scoop on the speeding torpedo-proof ship is a hundred feet deep and one hundred and thirty feet wide

Three searchlights are used on his multiple-hull ship at night to send their powerful rays ten miles ahead of the boat. As the ship draws on, the ray of light becomes ever narrower, so that the fish crowd densely together as they swim eagerly towards it.

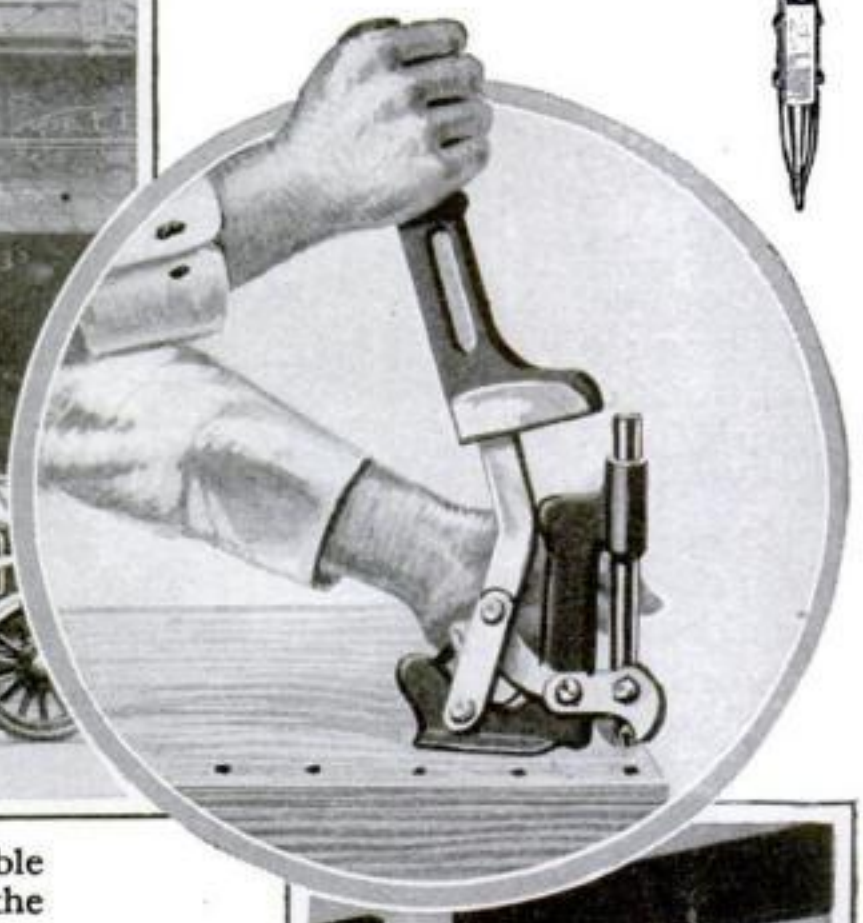
Then the huge wire scoop, a hundred feet deep and a hundred and thirty feet wide, which can be readily suspended from the front of the Lybeck type of boat, is dropped in the water. The ribs of this scoop are made like whalebones, so that water and debris can easily seep through and the fish can slide up, but never down and out of it!

When the teeming crowd of fish reaches the darkened scoop, this onrushing trap quickly swallows it up. Once near the end of the scoop, an endless-belt conveyor carries the fish to the assorting deck. Here a hundred men distribute them into cross conveyors which carry each fish into its respective refrigerator.

Do It With Tools and Machinery

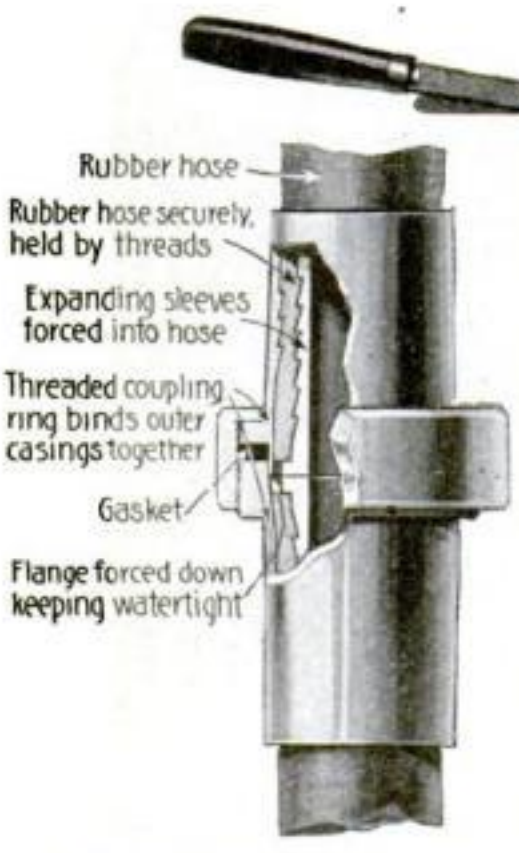


Above: A winch for lifting heavy objects to a considerable height. It is permanently fastened to the floor under the driver's seat and is geared to run by the truck's power

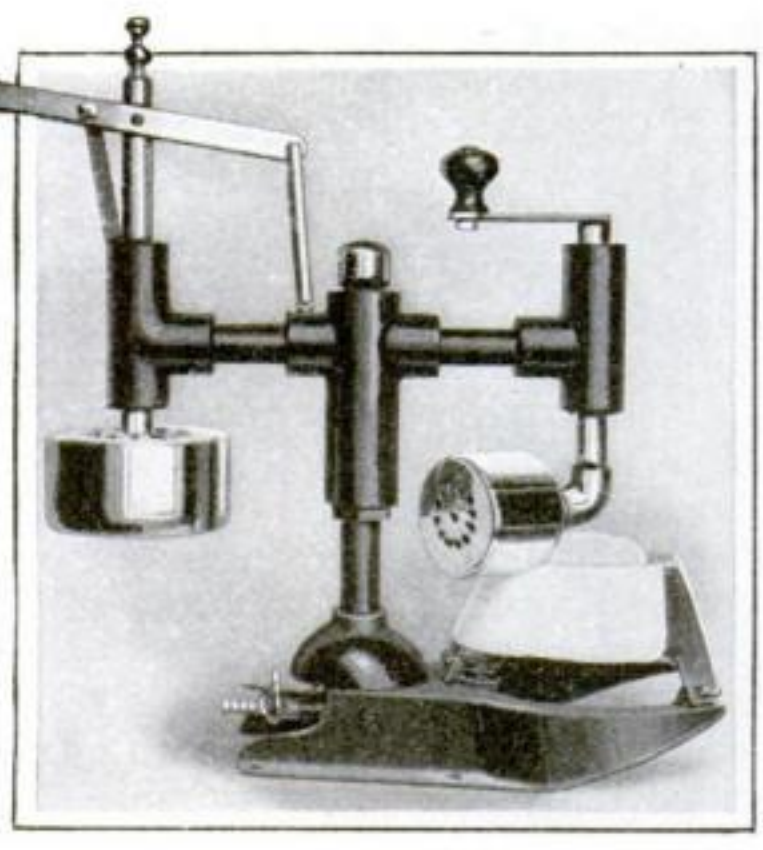


In circle above: With this nail-puller the operator can do his work without endangering his hands. It has a wide base so that it will not crush through under pressure

At right: A "gun" for driving nails in hard-to-reach places. It is a steel rod with a brass tube shank, having a larger tube enclosing a light coil-spring for a hand-grip. The tension of the spring is sufficient to hold the nail in the chuck end ready to be driven when it is set in place



A metal coupling for connecting the ends of a hose in a perfectly steam-tight joint, avoiding all leaks

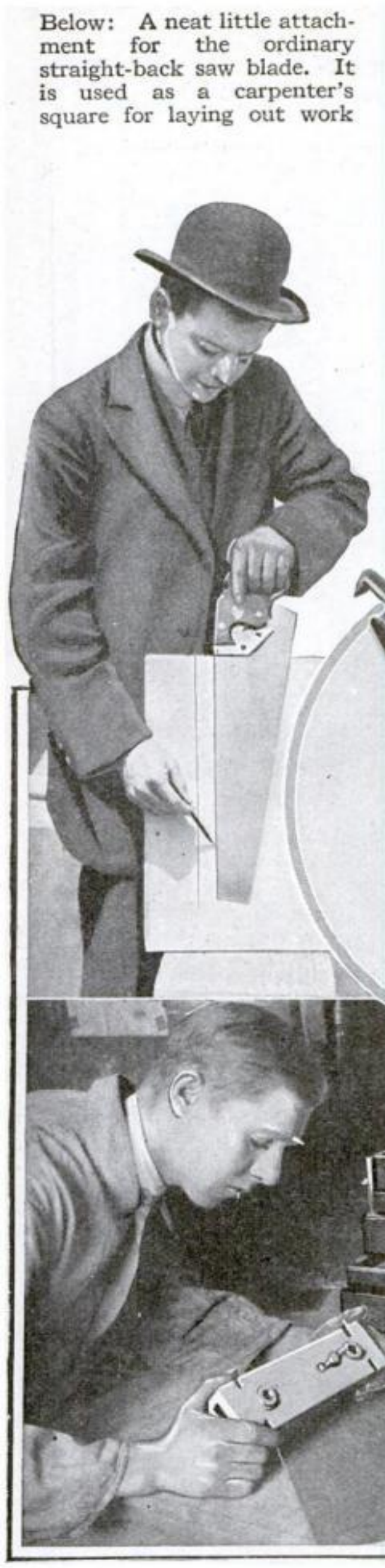


A motor-operated collar ironer with a revolving head which irons, rolls and polishes collars of different shapes without making them rough

A guide for use in putting hinges on doors and frames so that the holding pins can be inserted easily

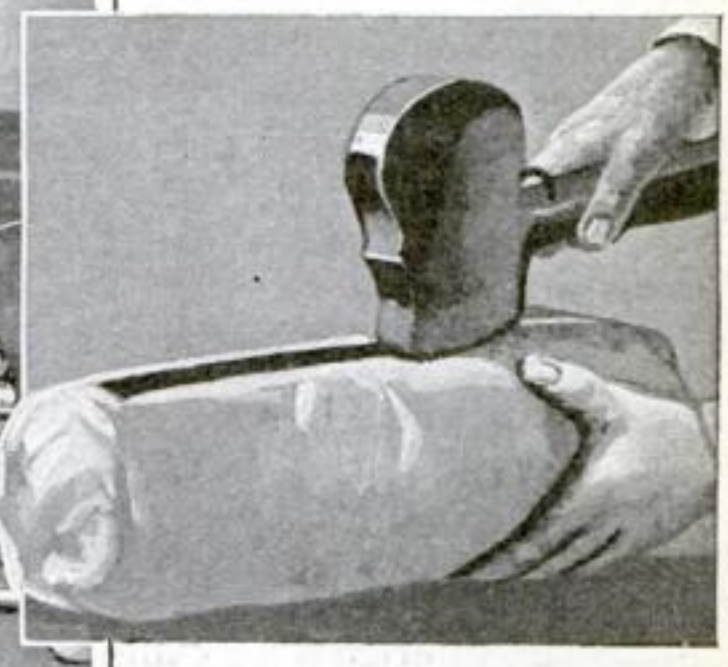
Do It With Tools and Machinery

Below: A neat little attachment for the ordinary straight-back saw blade. It is used as a carpenter's square for laying out work



Above: A breathing apparatus for use in gas-filled chambers or when working with chemicals

In circle: A cotter-puller which works like a pair of scissors, holding the pin securely after pulling it

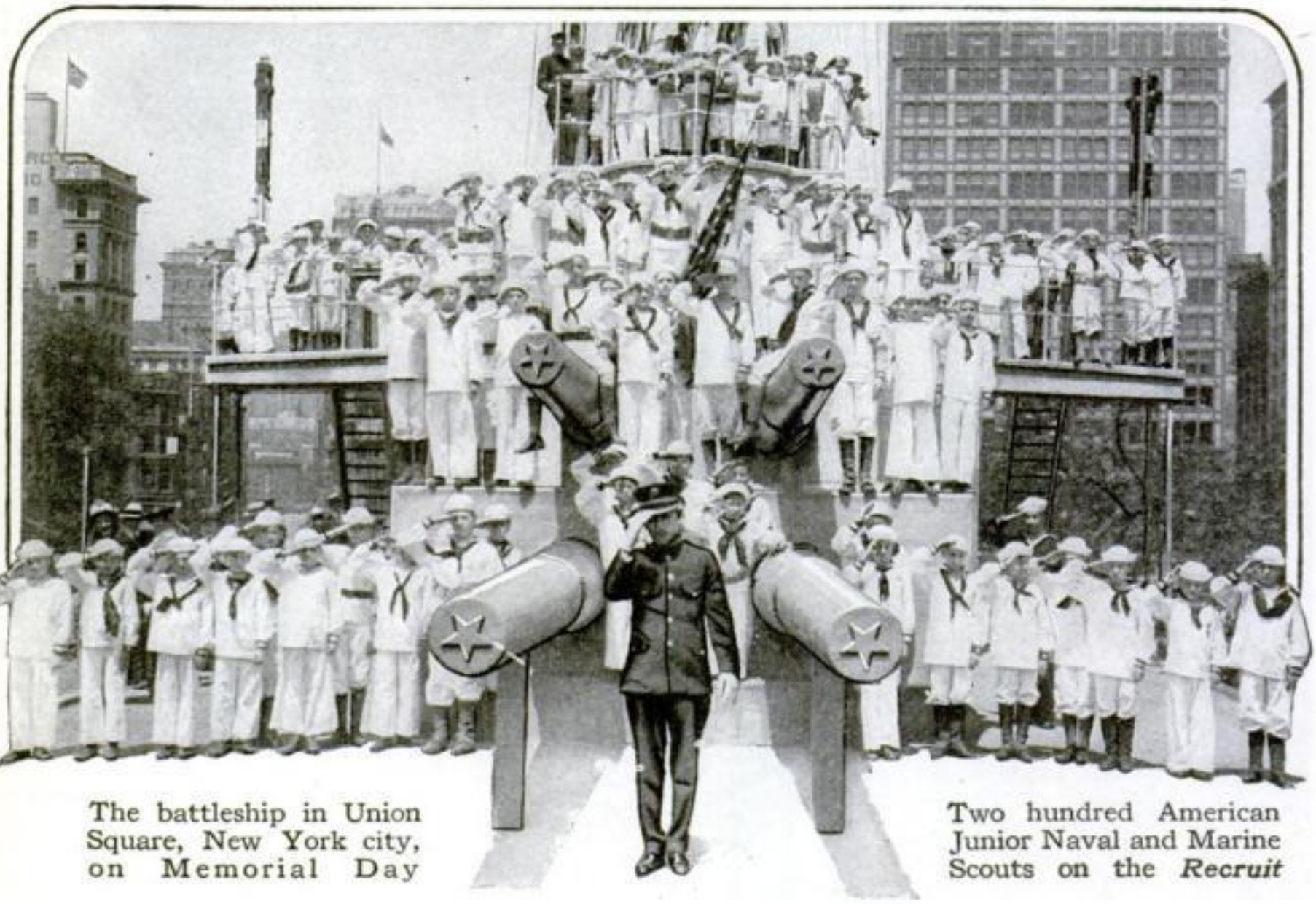


A gummed paper-tape holder for feeding, moistening and cutting without touching it with the hands when fastening packages

A tool cabinet which is so compact and at the same time so commodious that it will appeal to any mechanic. There are spaces provided for every kind of tool that ordinary shop work calls for

The "Recruit"—Our Only Land Battleship

It is New York's recruiting center for enlistment in America's first line of defense

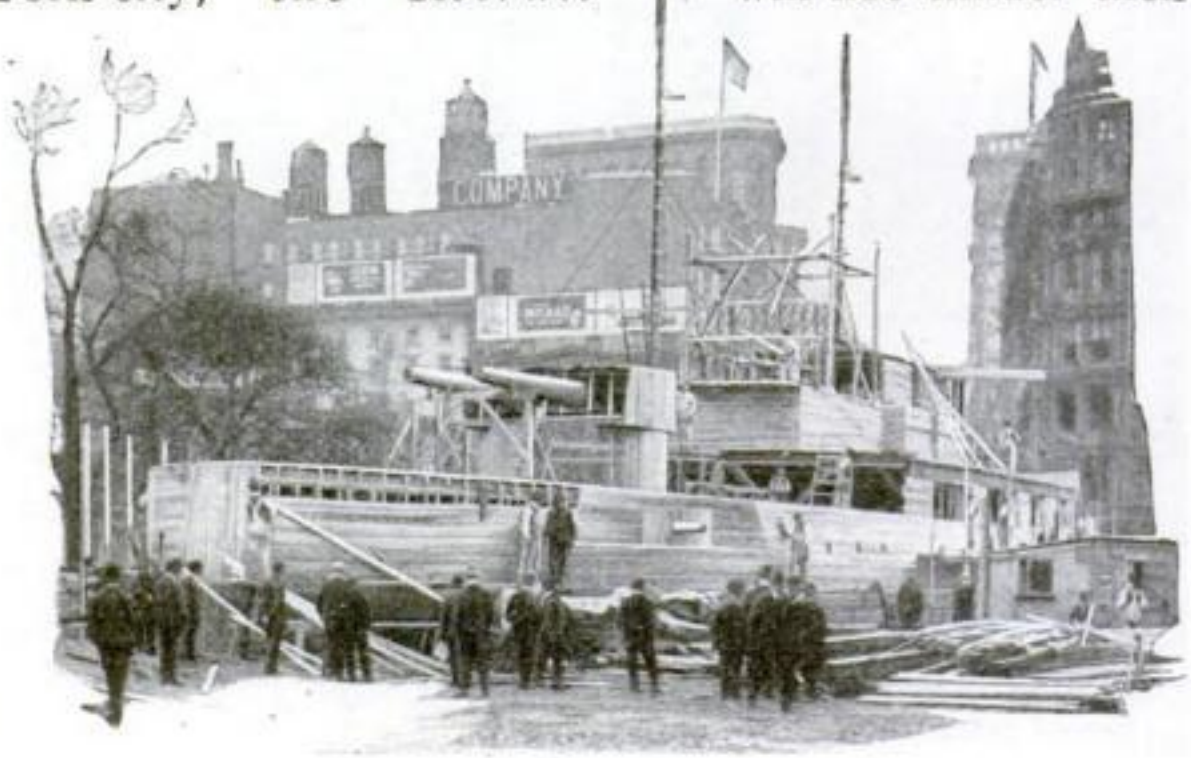


The battleship in Union Square, New York city, on Memorial Day

Two hundred American Junior Naval and Marine Scouts on the *Recruit*

WHEN Rear Admiral Bradley A. Fiske published his great article on "If Battleships Ran on Land," in the POPULAR SCIENCE MONTHLY for November, 1915, showing, as it did, the tremendous energy of a battleship on land and the destruction it would work while crashing down Broadway, New York city, he little dreamed that a real battleship would be anchored close to the subway in Union Square in the year 1917. Needless to say, the land man-o'-war that now overlooks Broadway is the antithesis of the land monster conceived by Rear Admiral Fiske. Although it looks formidable enough, it is simply the headquarters for Naval recruiting in the New York city district of America's first line of defense. It has been aptly christened the *U. S. S. Recruit.*

It is a fully-rigged battleship. On the starboard side of the ship flies the flag of the Navy, while from the port side flies the emblem of the Marine Corps, the "Soldiers of the Sea." At the present time the ship houses thirty-nine bluejacket guards from the Newport Training Station—young fellows who have seen from two to six months' service. Their duties on board the *Recruit* will not hinder their



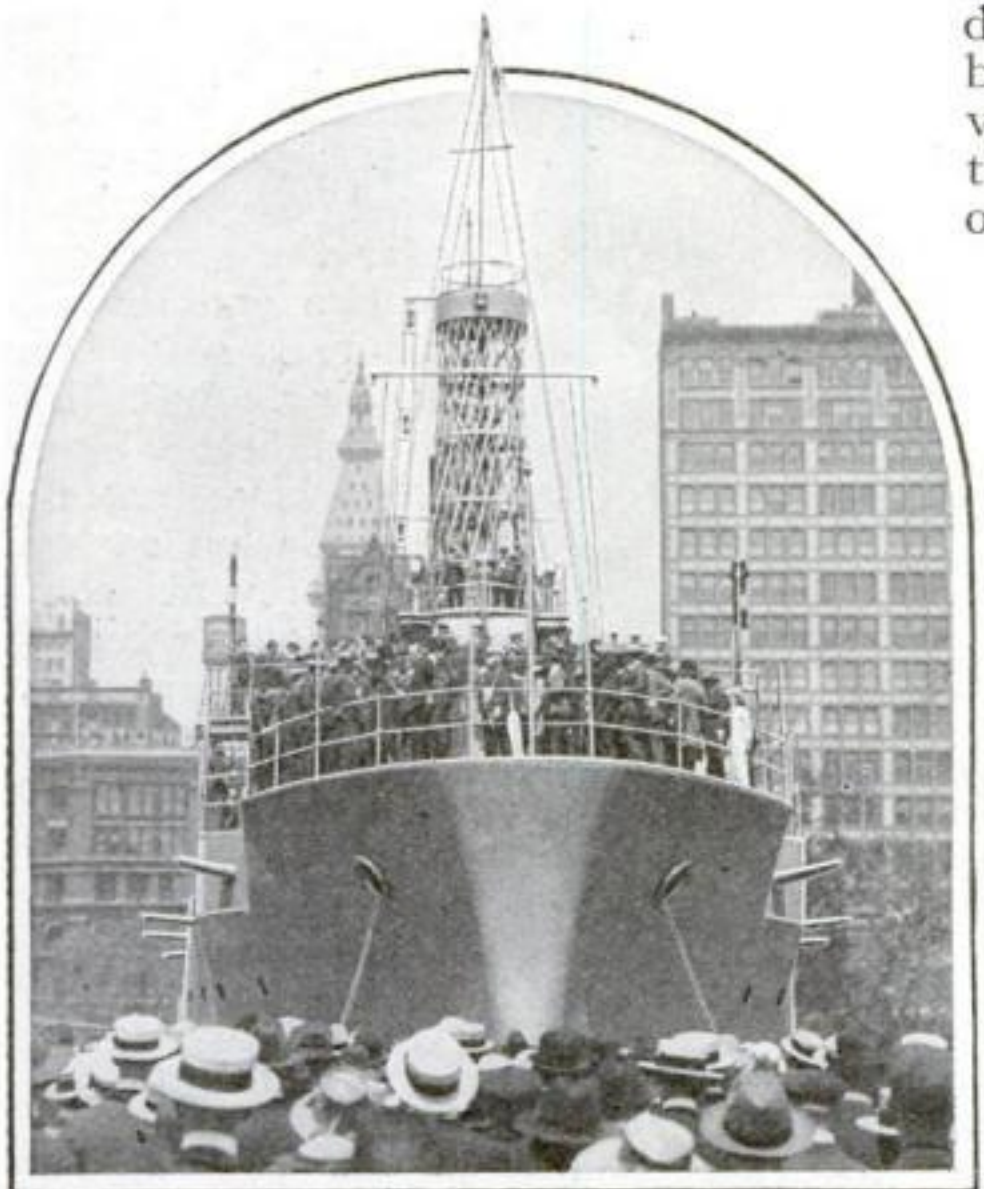
The *Recruit* in process of construction. It was several days before she resembled a superdreadnought

progress in naval affairs, for the *Recruit* will be as much of a training ship as it is a recruiting center. On the other hand, citizens may visit the ship and acquaint themselves with the makeup and organization of a modern sea-fighter.

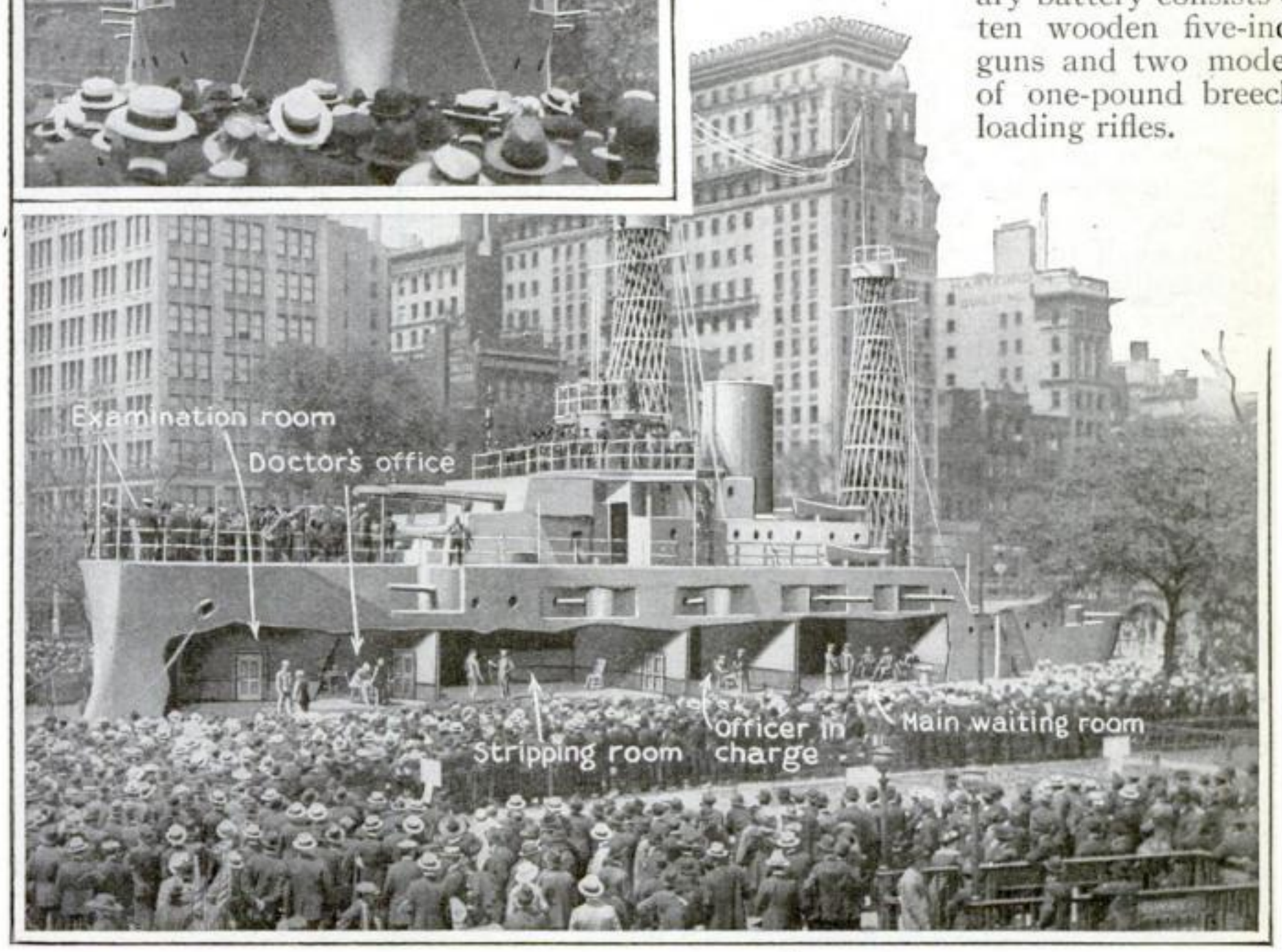
Under Acting Captain C. F. Pierce, life aboard the *Recruit* is one of ordinary naval routine. The land sailors arise at six o'clock, scrub the decks, wash their clothes, attend instruction classes, and then stand guard and answer questions for the remainder of the day. There is a night as well as a day-guard. From sundown to eleven o'clock all lights of the ship are turned on, including a series of searchlight projectors.

Within the ship are spacious waiting rooms for recruits and applicants, physical examination rooms both fore and aft, doctors' quarters, officers' quarters, shower baths, a big air washer and ventilating device which changes the temperature ten times every sixty minutes, and numerous other accommodations for officers and men.

The superstructure of the vessel consists of a forward cabin, main bridge, flying bridge, conning tower, two masts fifty feet above the quarterdeck, and a single smokestack eighteen feet above the cabin top. Six wooden guns, representing fourteen-inch naval guns, extend seventeen and a half feet beyond the turrets and make up the main battery. The secondary battery consists of ten wooden five-inch guns and two models of one-pound breech-loading rifles.



The *Recruit* measures two hundred feet from stem to stern, with a forty-foot beam



The equipment is that of the up-to-the-minute dreadnought with accommodations on board for day and night life of officers and men. Searchlight projectors illuminate the ship at night

Scraping a Bat—Why Is It Done? O, Just Because

BASEBALL players are as superstitious as Zulus. In no way is this more lucidly illustrated than in the care which some of them lavish upon an ordinary baseball bat. Manufacturers oil and shellac their bats to make them sleek and fresh, and the superstitious baseball player proceeds to use glass, bone, sandpaper and what-not to remove the finish. Why? O, "just because"—to give a woman's reason. He may have a notion that the bat will last longer without it. But the truth is that the shellac really acts as a preservative to the wood.

Some baseball players imagine that it is impossible to make a strong hit with a new bat, because the bat is so sleek that the balls glance off it. Others believe that scraping a bat fills up the crevices and cracks and thus lengthens the life of the bat. The accompanying photograph shows Cueto, a Cuban who plays an outfield position for the Cincinnati Reds, combing his bat with a calf bone.

Cueto, of the Cincinnati Reds, combs his bat daily with a calf bone

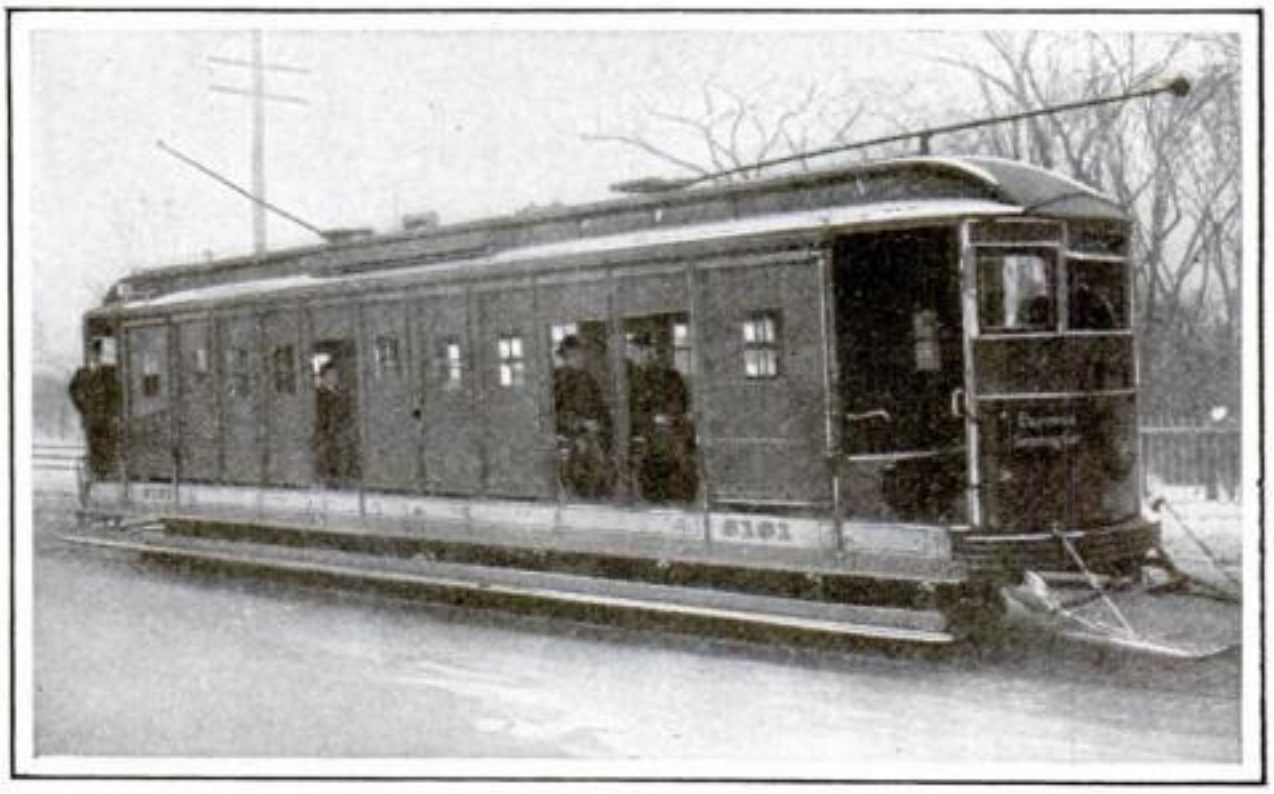
A baseball player may change his bat occasionally for a lighter or heavier one, and when he does so the principal sporting goods stores in the country are at once apprised of the fact. One big store, for instance, has on hand the exact weight and style of bat used by every big league player in the United States. When a player breaks his bat all he need do is to send a telegram such as this: "Express me a bat, quick. Tom Jones," and he will get a duplicate of the bat he broke. Most bats are made of second-growth Northern ash, dried in the sun. This wood is becoming scarce.

An Improvised Street Railway Smoking Car

INCREASED traffic and car shortage on a street railway property in the East during the past winter months made some of the operative heads do quick scheming in order to cope with the situation. As a result, some of the open summer cars were equipped for "shop service" in winter. The company took ordinary fourteen-bench open cars and placed electric heaters under the seats, except the two end seats and the two seats corresponding, just inside the bulkheads. The heaters have sheet-iron guards on each side to prevent contact with the passengers' shoes or clothing. Tests showed that such a battery of heaters provided a comfortable temperature.

In order to retain the heat thus generated in the car, the sides were equipped with transparent, non-inflammable windows. These flexible windows in the curtains provided ample light for reading.

To encourage passengers to ride on the cars they were run on express schedules and termed "Express Smoking Car."

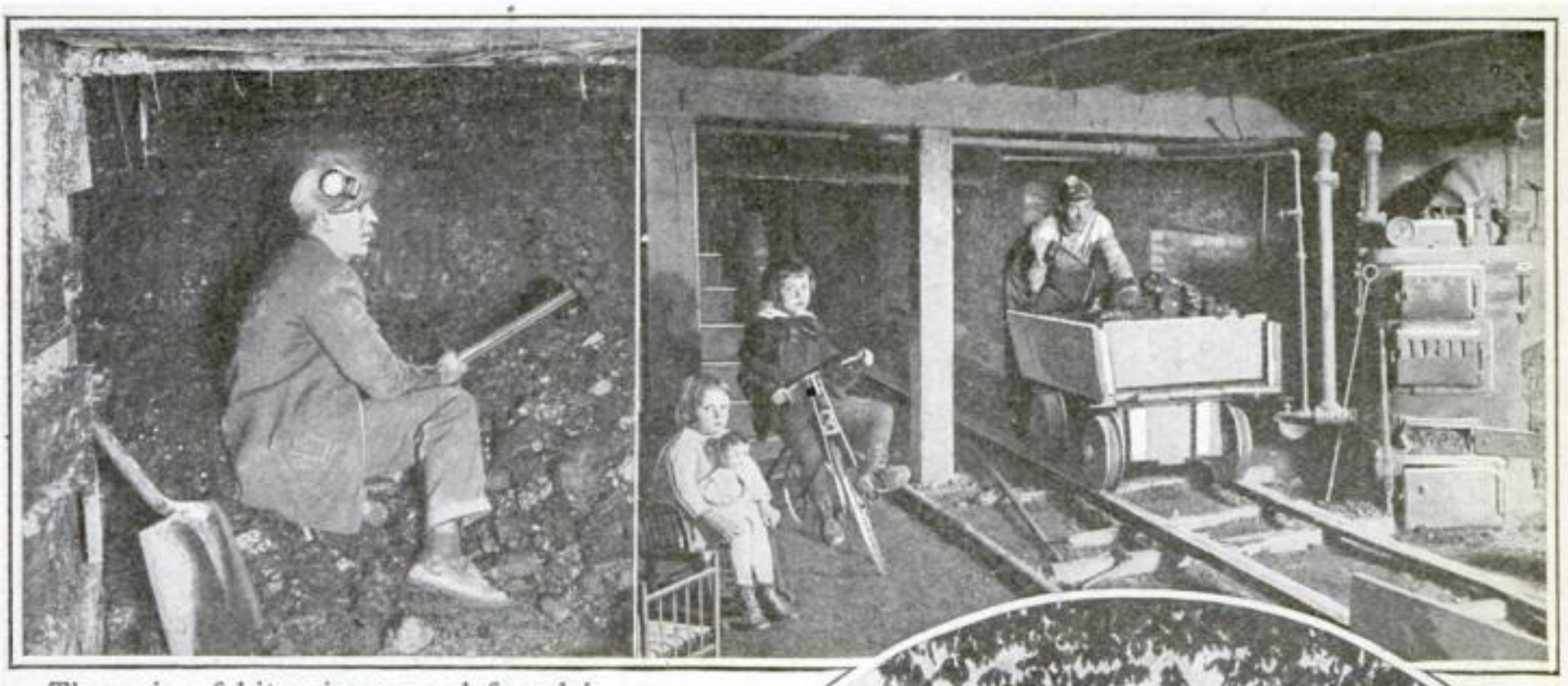


An open summer car equipped with curtains, heaters and windows, for a "smoker." It ran on an express schedule

All the specialized knowledge and information of the editorial staff of the Popular Science Monthly is at your disposal. Write to the editor if you think he can help you.

He Finds a Coal Mine in His Cellar

Coal may sell at eighteen dollars a ton but this fortunate lawyer can have all he wants at thirty cents



The vein of bituminous coal found in the cellar measures five feet in width

At right above: It's only a step from the coal mine to the hot-water heater

The home of Mr. Bandy, under which the vein of coal was discovered

THE purchasers of property in the residence section of Norton, Va., will hereafter be inclined to examine the cellars of their prospective homes very carefully in the hope of locating some such bonanza as did H. M. Bandy recently.

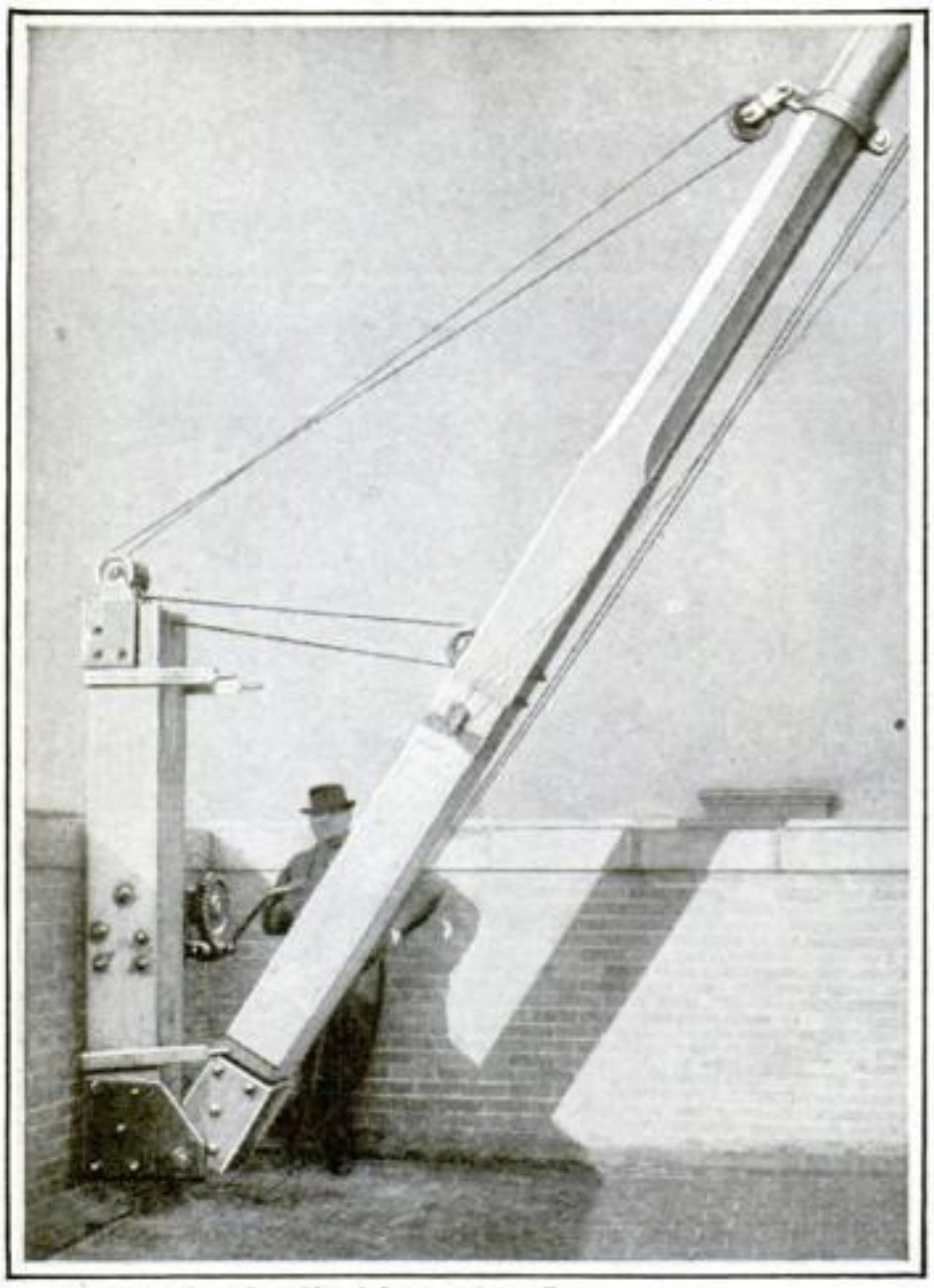
Mr. Bandy was excavating in the cellar of his newly-purchased house in order to install a hot-water heating plant. Almost on the spot where the furnace was located, an old negro workman discovered the "bloom," which is a black carboniferous earth found always on the edge of a stratum of coal. "Boss, youse got plenty of coal back up in the hill," the old negro said. "These am the outcroppings."

By the time the cellar had been excavated to the desired width, enough coal had been taken out to supply the family for the entire winter. Then Mr. Bandy started to drive a "heading" back up into the hill on which the house stands. The heading, which leads from the furnace out under the garden, is ten feet wide. Mr. Bandy has installed a small track of wooden rails on which a hand car can be pushed back and forth for loading and unloading.

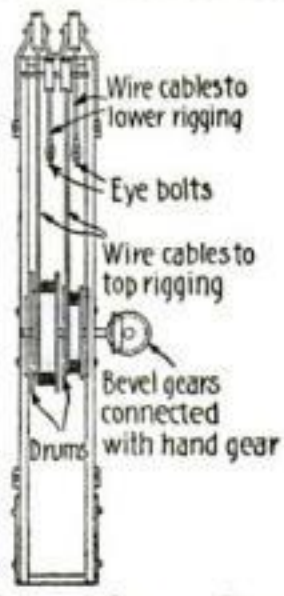
As the vein of coal is on a grade, even this work has been simplified for him; for when loaded, the car slides down the track to the dumping place almost unaided, and when emptied it is a child's task to push it back to the loading place again. This down-hill grade also provides natural drainage for the mine, keeping it free from the water which seeps into it from the garden immediately above.

At present the mine is yielding from ten to twelve tons of coal a day, with only one miner employed. Dynamite is used in minimum amounts to loosen up the strata and lessen the work of the miner without disturbing the inmates of the house or the rapidly developing plants in the garden.

The town of Norton is in the center of a big bituminous coal region. According to the local recorder, "Dig a post hole and up comes coal. Lay a waterpipe, and some coal has to be removed from the right of way." Mr. Bandy's private coal supply costs him about thirty cents a ton.



Instead of climbing the flag pole to repair it, one man lowers it to the roof where it can be painted with less danger



Flag Pole Repairing Minus the Usual Steeple-Jack

SPECIALIZED pole painters and steeple-jacks may soon find themselves unnecessary adjuncts to the business world, if the ingenious flag raising and lowering device shown in the accompanying illustration becomes popular. It can be used on all flat roofs. Instead of the men climbing the pole, the pole is brought down to the men by means of a system of gears, which can be operated by one man. These gears are mounted on a short hollow post which is fastened to the building. They operate a drum which is divided into two portions. Upon these portions, the pole tackles wind up.

The drum which winds up the cable going to the top sheaves is larger than the other, so that this cable will wind up faster and keep its tension the same as the lower cables, as the pole swings up on its hinging pin. When fully raised, two stirrups hold the flag pole securely against the shorter anchoring post.

The Tender Chloroforming, Antiseptic Bayonet—It Wounds and Heals

HOW can we make the soldier fight harder? Can we do it by giving him new implements of torture, new weapons to increase bloodshed? "No," is the answer of Alexander Foster Humphrey, of Pittsburgh, Pa., inventor of the gentle narcotic hunting bullet and the polite antiseptic, anaesthetic military bullet.

"Relieve the conscience of the soldier," advises Mr. Humphrey, "and he will fight the harder. Let him know that while he must cause a wound, he is also giving means to relieve and heal that wound and he will fight like a tiger."

All of which whether true or not serves as an introduction to Mr. Humphrey's most recent and most astonishing invention, the antiseptic, pain-deadening bayonet—a bayonet that carries in its blade a capsule containing a mixture of antiseptics, anaesthetics and gelatin. When the bayonet is plunged into a soldier the heat of the body will melt the capsule and release its healing contents, the anaesthetic deadening the wounded man's pain, the antiseptic preventing infection, and the gelatin stopping the flow of blood. We wonder if a Belgian soldier would relish the stabbing of a German so tenderly.

The bayonet which heals the wounds it makes. A groove in the end of the blade holds an antiseptic, anaesthetic capsule

A New French War Word Which Means "Fooling the Enemy"

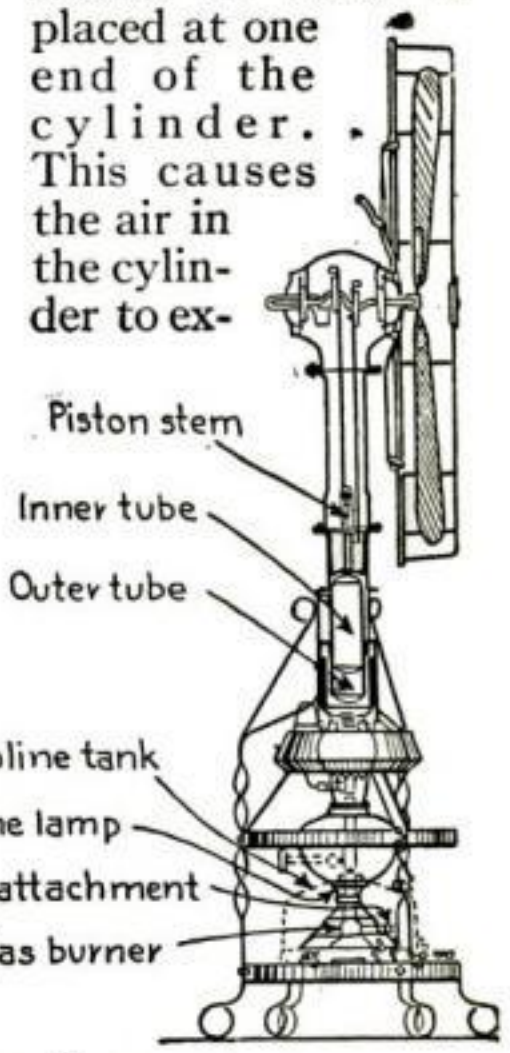
SINCE the war started the POPULAR SCIENCE MONTHLY has published photographs of big British and French field pieces covered with shrubbery, railway trains "painted out" of the landscape, and all kinds of devices to hide the guns, trains, and the roads from the eyes of enemy aircraft.

Until recently there was no one word in any language to explain this war trick. Sometimes a whole paragraph was required to explain this military practice. Hereafter one word, a French word, will save all this needless writing and reading. *Camouflage* is the new word, and it means "fooling the enemy." Example:—A dead horse lay between the British and German lines on a bit of rising ground. During the night the dead horse was removed and an imitation, with a man inside, was substituted. The men who constructed and painted the fake horse practiced *camouflage*. They are known as *camoufleurs*.

The motor of the fan is operated by kerosene, alcohol or gas. At right is shown a diagram of the equipment

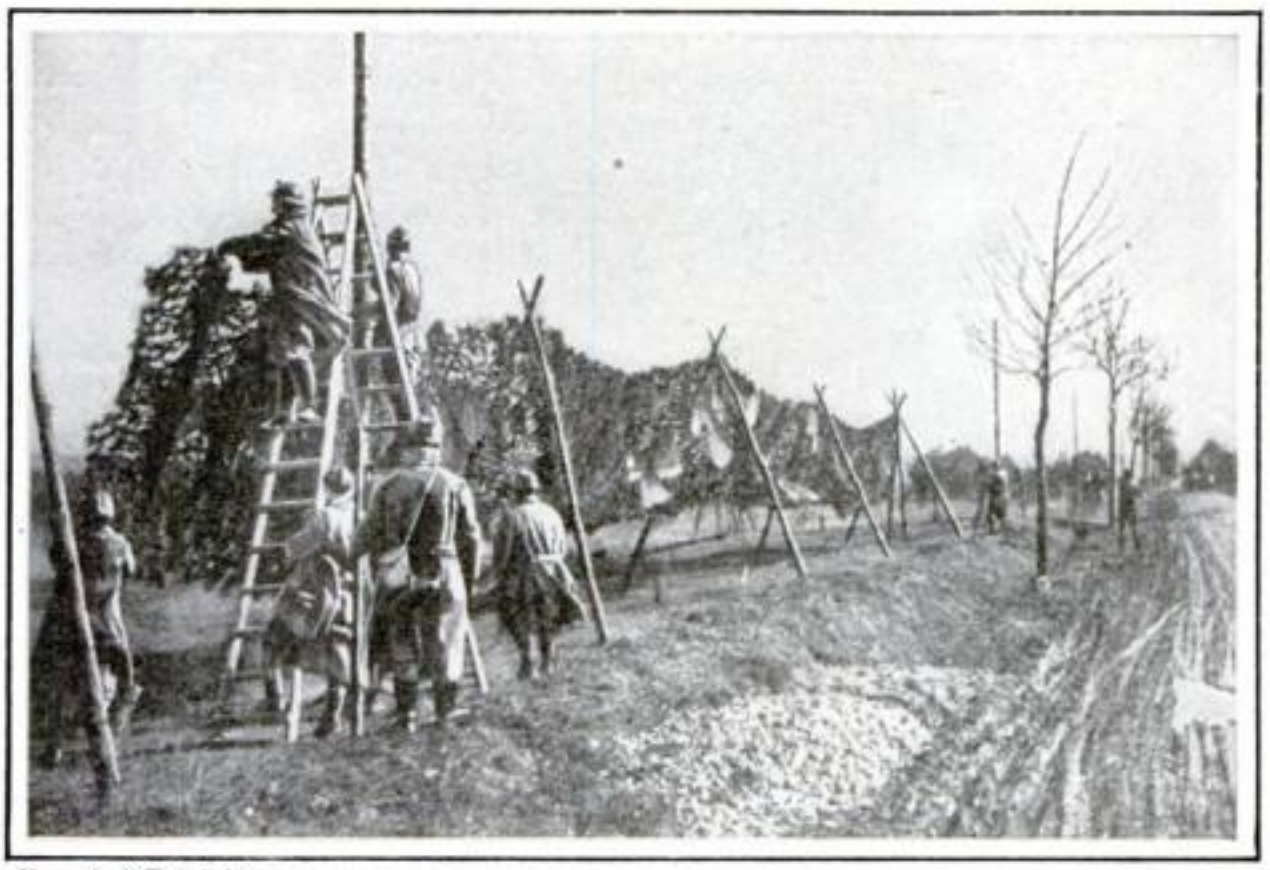
A Motor-Fan That Works Without Electricity

ALL the benefits of the electric fan may now be had in places where electricity is not available by using a fan driven by a motor operated by alcohol, gas, or kerosene. The motor is really an adaptation of the air engine. The alcohol lamp or other source of heat is placed at one end of the cylinder. This causes the air in the cylinder to expand and to exert pressure on a sliding piston at the other end. This acts in such a manner as to push on the crankshaft.



A second piston, called the transfer piston, at the proper time forces the hot air from the burner end to the cool end of the cylinder, where it cools and contracts. The atmospheric pressure then pushes back the sliding piston, which pulls the crankshaft. Thus power is exerted on both the upward and downward strokes. The same air is used over and over again, obviating the need for an exhaust and preventing odors.

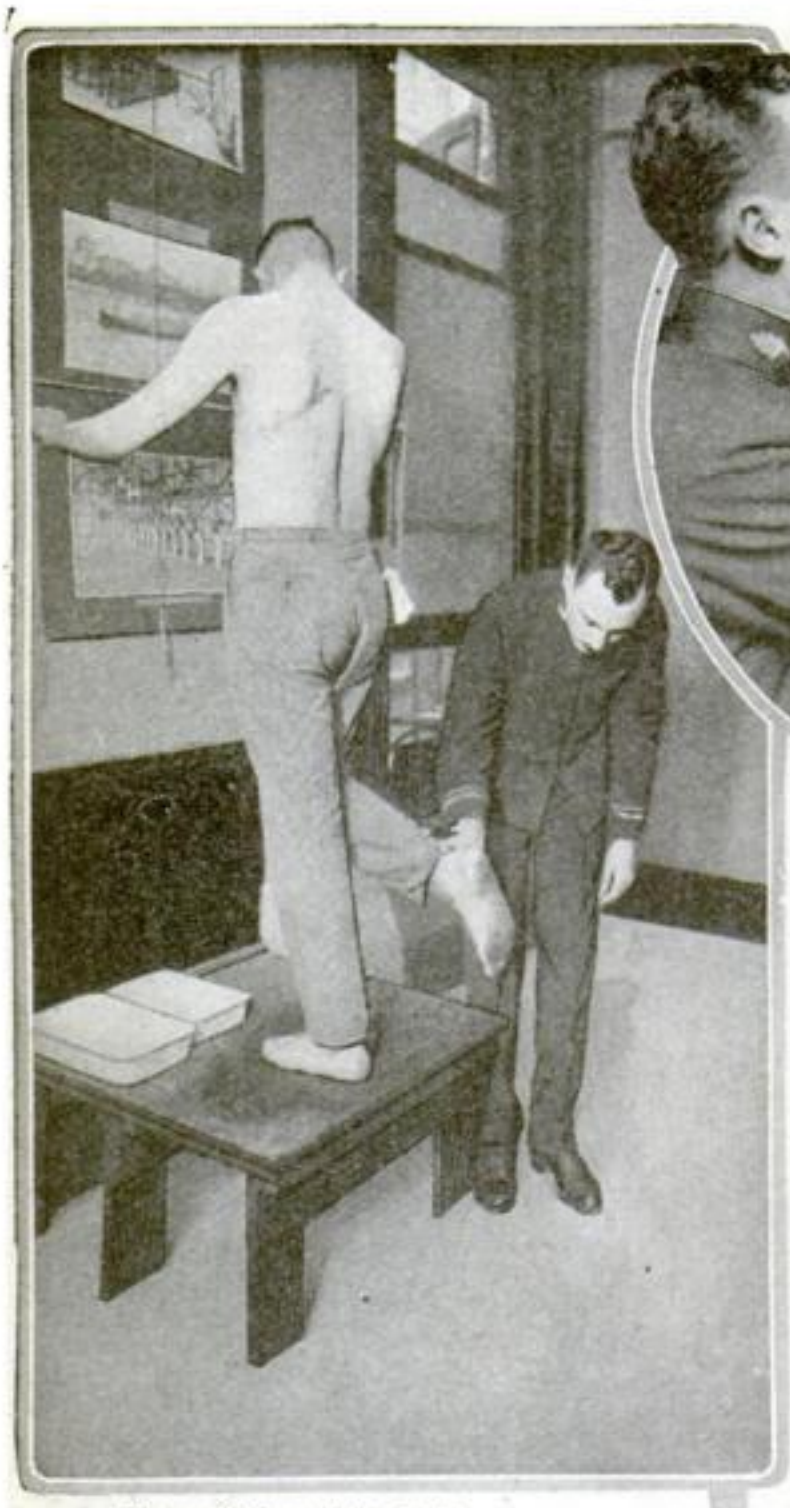
The small fuel tank, placed in the lower portion of the stand, holds enough fuel to last for a twenty-four-hour run; it drives the fan at 500 to 700 revolutions per minute.



French Official Photo

Camoufleurs, members of an important camouflage detachment, are here shown hanging mats of leaves on a framework of tall poles, to prevent the enemy from seeing the road

Why They Were Rejected



Hold that pose, Oscar, while we count the molar stalactites and stalagmites in your Mammoth Cave. By Jove, old top, you have six ivories missing. Sorry, but that disqualifies you. Yells Oscar, "Isn't it enough to kill the Germans or do I have to eat 'em too?" Bad teeth mean rheumatism and poor health

"You listen well," says the doctor, musingly, "but I can tell from the way your internal gears mesh that you would travel in 'low' when leading a charge. Breathe naturally now, and I'll see whether your heart has a little movement of its own or not." The recruit is murmuring the prayer, "Oh death, where is thy sting-a-ling?"

Photos © Press Illus. Serv.

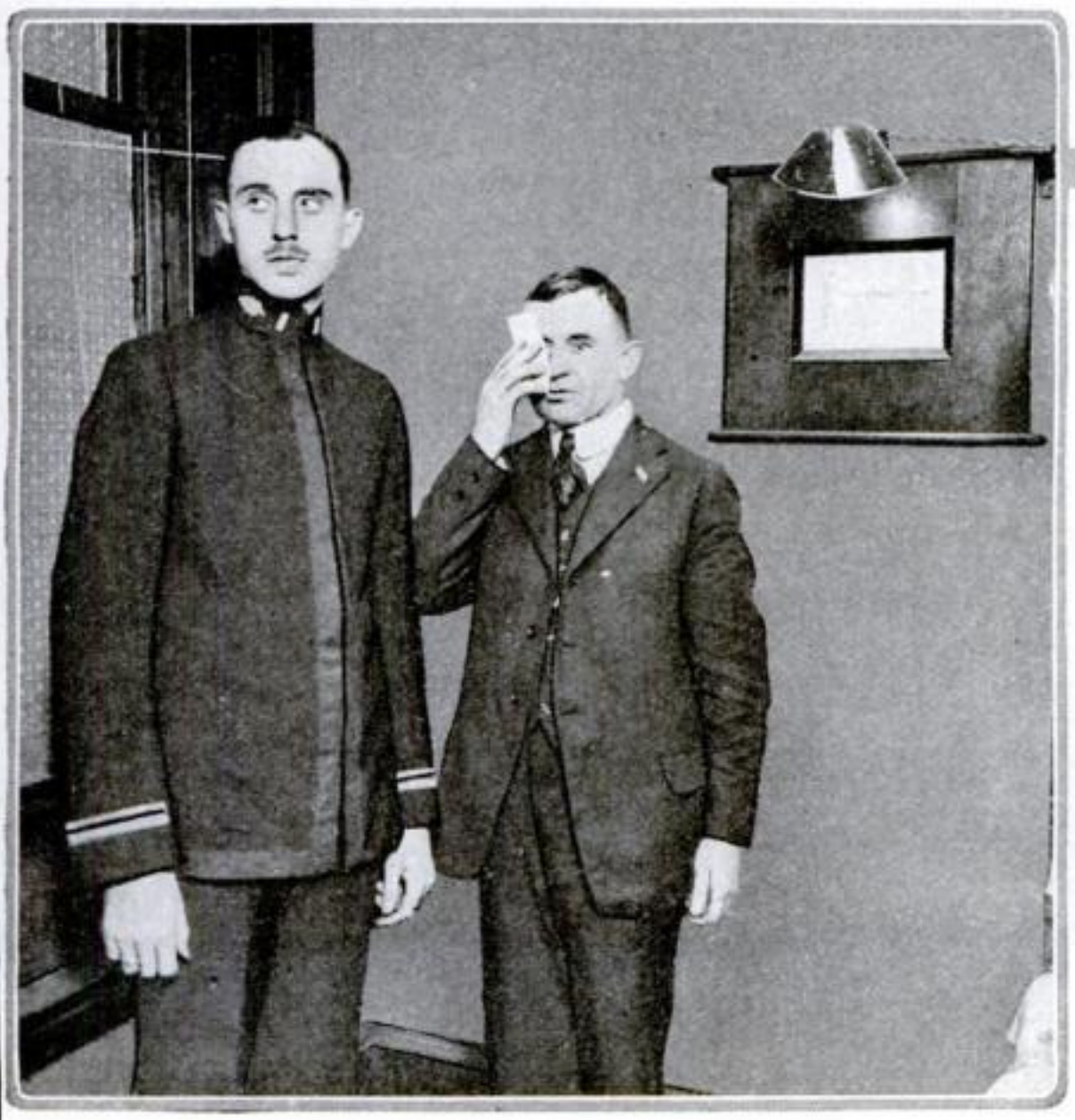
Stand up straight, lift the right leg and say "Uncle" three times. Ah! ha! he has flat feet, hammer and over-riding toes, corns, bunions and ingrowing nails. He couldn't march far. Otherwise he is admirably fitted for military service. Admire the Junoesque arm if you must

The color test or does black belong above or below the Mason and Dixon Line? It is a hard test, this color gamble. You are given five minutes to pick black from white and if you fail the first time you are only given two other chances. A color-blind person can't shoot straight

Why They Were Rejected

Has he a little Prussia in his dome? Let the doctor decide this, and also pass upon his hearing. The Marine Corps demands that a recruit have good hearing, otherwise how would he know to obey an order to retreat

At right above: Taking his measure. If the height limit is five feet four and the recruit but five feet three it is possible (so they say) to make up the extra inch between the waist line and shoulder. Seven-foot soldiers aren't nice to look at; four-footers can't march fast enough



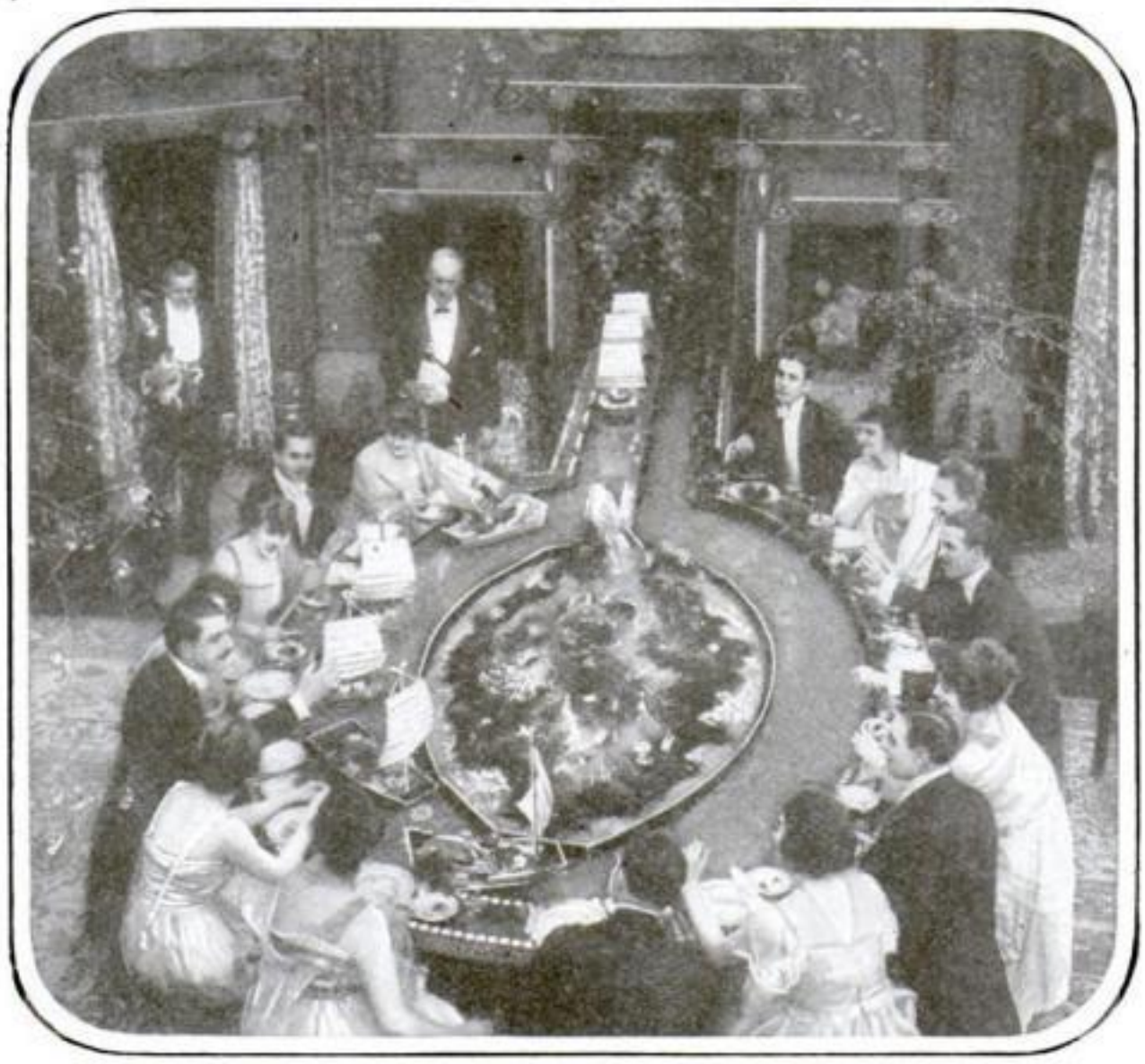
Photos © Press Illus. Serv.

Underweight? Go home, fill up on olive oil and milk and go to bed. Overweight? Pick out a forty-storied building and walk to the top ten times a day. Fat men can't stand the pace; skinny ones haven't the endurance

Close one eye and see if you can pick out a German at twenty feet. Very good. Now close the other and see if you can read those letters. Fine, you will make a sharpshooter after peace comes and firearms are taboo

A Dinner Served in Gondolas on a River of Champagne

THE dinner being served in the accompanying photograph is probably the wettest on record. It literally floated on champagne (the stage variety). As one might suppose the novelty is the product of the combined imaginations of a motion-picture director and his technical assistant. The scene represents a banquet in a recent Fox production.



The gondolas loaded with dainties float from the kitchen to the guests and back again, on a flowing river of "stage" champagne

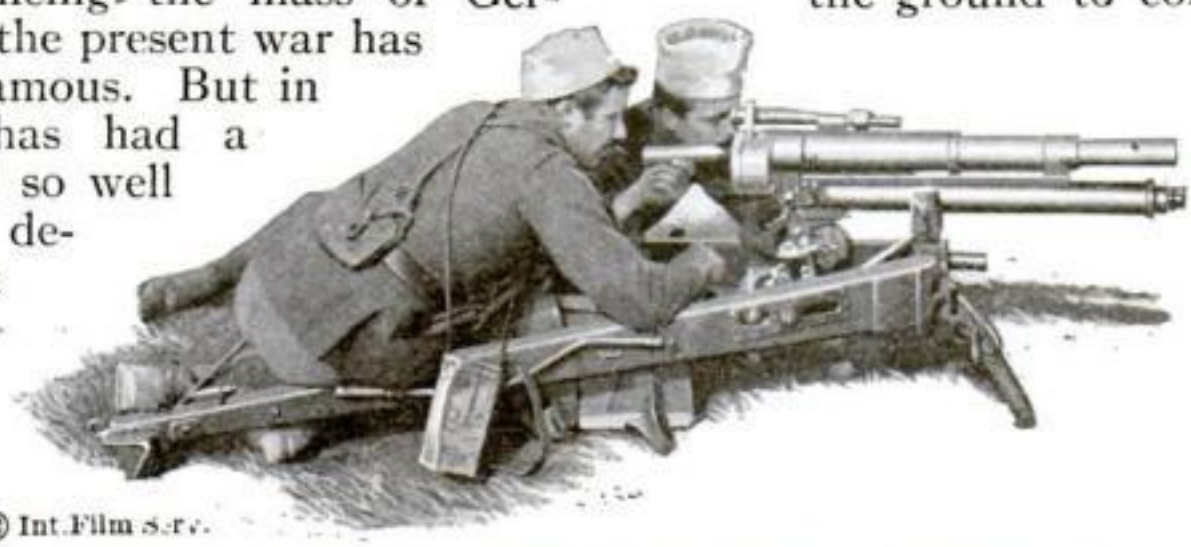
A table was constructed with a canal about a foot wide running round it. The ends of the canal were extended into the kitchen where a water wheel lifted the liquid from the lower end of the canal to the higher end. The gondolas were loaded with meats and viands at this end and sent on their journey.

Fighting German Machine-Guns with the French "37"

THE great work of the French "75" in counterbalancing the mass of German artillery in the present war has justly made it famous. But in that work it has had a smaller ally, not so well known though deserving of most honorable mention. This is the French "37," a small quick-firing cannon which advances with the skirmishing first line, seeking to destroy the German machine-guns.

A machine-gun destroyer it is in very truth. Germany relies on machine-guns and artillery to hold a battle line. Machine-guns and light artillery, then, retarded the advances of the French—until they answered cannon with cannon in the famous "75" and the distinguished "37."

A more beautiful weapon than the "37" for filling the rigid requirements of a skirmishing cannon is not to be found anywhere. It ably meets the first requisite of portability; the gun and mounting can be quickly taken apart and carried over the most shell-torn ground by the six or eight members of its crew. It is accurate—a French officer says there exists no other gun more accurate! It will hit the muzzle of a machine gun at a distance of a mile. And its speed of fire is remarkable. A well trained crew can fire thirty-five high-explosive shells, of nearly one and a half inches diameter, every minute, while they are crouched upon the ground to conceal themselves from the enemy!



© Int. Film Serv.

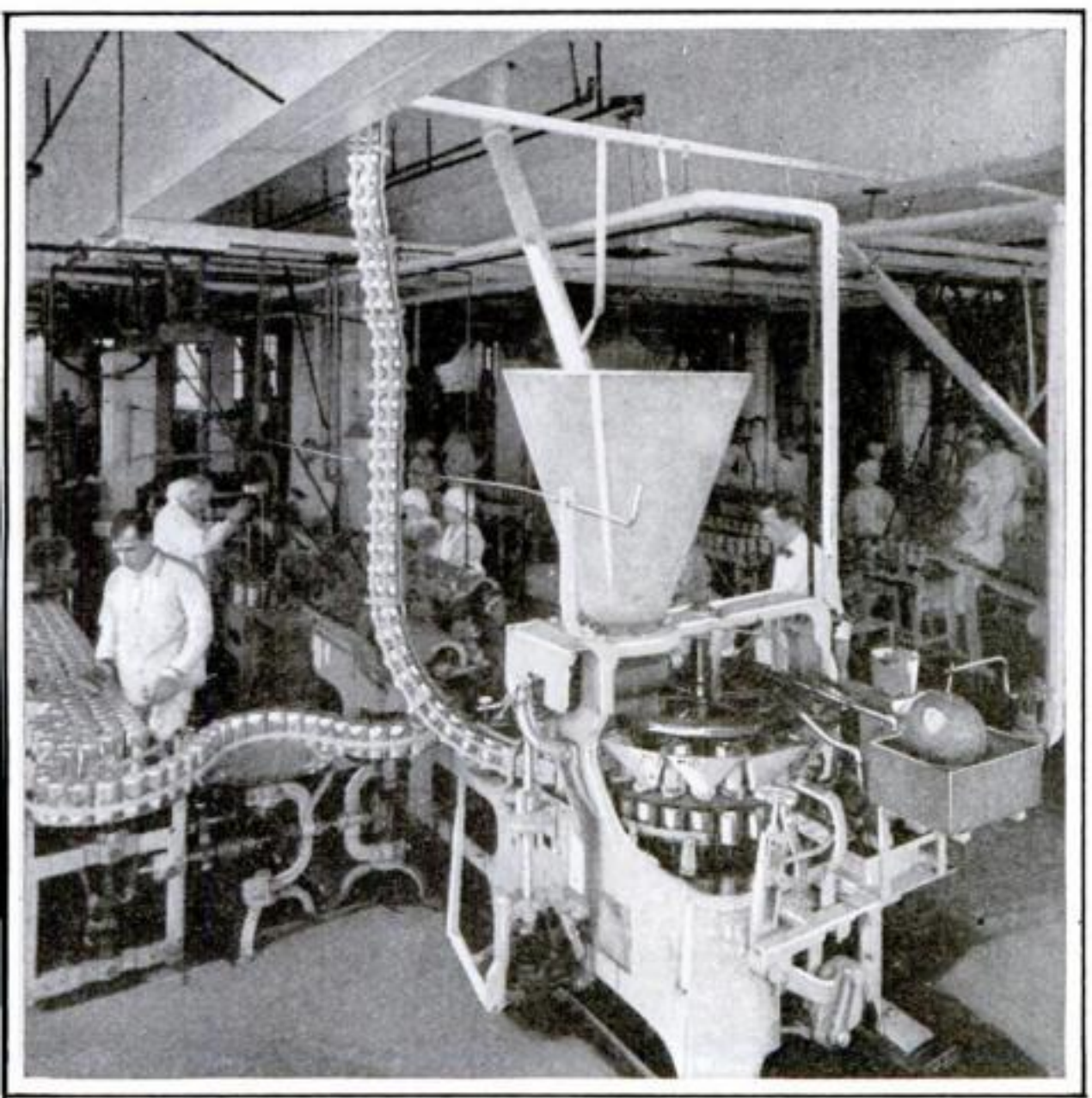
This French portable, quick-firing cannon advances with the skirmish line to destroy the enemy's machine-guns

Military expediency prevents the public from knowing the details of this machine, but when the story of this war is told, the "37" will not be found wanting.

Filling Nine Thousand Cans of Beans an Hour

ARMIES may fight with bullets, but they live on beans. The Civil War was fought on a diet of our dried army beans; this war is waged with canned beans.

In the photograph below is shown a modern bean-canning factory working at the height of production. To meet the extraordinary demand for beans, labor and time-saving machinery is used exclusively. Although located in New Jersey the machine illustrated fills up the cans with Boston baked beans and snaps on the covers in practically the same operation. The empty cans are fed to the machine in an endless stream, the cans being held in place by a metal frame. The machine fills the cans at the rate of nine thousand an hour but it can work faster, if needed.



The bean-filling machine with its funnel is in the foreground. To the left are the solderers which seal nine thousand cans an hour

The Largest Human Mouths in the World

DR. GREENBAUM, an enterprising young dentist in Cincinnati, eager to help Uncle Sam in demonstrating to the volunteer the necessity of getting his mouth in good shape before enlisting for the front, devised what are probably the largest scientifically-correct models of the human mouth in the world.

The largest mouth in the world—a model for a dentists' exhibition

Each model (and there is an extended series of them) is two feet deep by eighteen inches wide and eight inches tall. The models are hollow and fashioned of plaster-of-Paris, held together by gauze.

Ten models of the adult mouth, three of the child's and four panels emphasizing certain phases of disease of the teeth and of decay, comprise the set. The models show the pulpy substance containing blood vessels, nerves, as well as the harder root and bony portions.

Europe Is Starving for Gasoline

FRANCE, one of our largest automobile and truck buyers, has prohibited the importation of foreign motor vehicles, except for government account simply because of the difficulty of obtaining gasoline. Gasoline is now selling in France at about a dollar a gallon. Each automobile owner is allotted a small amount per week. India and Holland have likewise prohibited the importation of motor vehicles for the same reason. Denmark's gasoline situation was so acute that it stopped the driving of passenger cars through the steets. It is said that taxicabs in Berlin have been running on alcohol for two years now.

A Ten-Thousand-Dollar Map of Warring Europe

IN the lobby of one of Chicago's large office buildings is a huge relief map of the European countries where the war rages, exhibited to the public and lectured upon by a former war correspondent. The main map is 10 x 20 feet, but owing to its convex construction it contains an area of 300 square feet. It is a segment of a 90-foot globe. It was made by William Robertson, with the assistance of ten men. It took them nine months to make it. Including labor and materials, the cost of the map is estimated to be $10,000.

The map is a segment of a 90-foot globe, with heights and depressions clearly represented. Every battlefield is shown

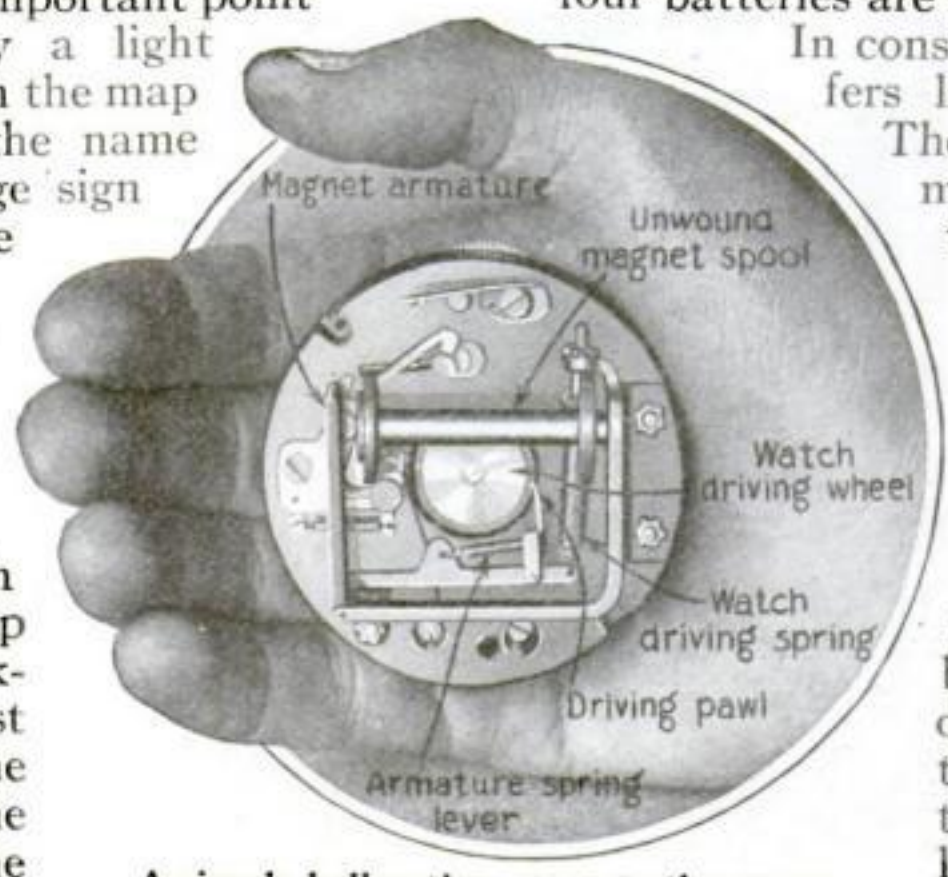
A special feature of the map is a system of small incandescent lamps which are flashed in connection with a large signboard made up of two hundred small transparent illuminated signs, each bearing the name of an important point on the map. When the lecturer mentions an important point in the war territory a light flashes at that point on the map and simultaneously the name is flashed on the large sign which is located at the left side of the map. This makes it possible for the spectator to follow the lecturer more closely and intelligently.

The method used in constructing the map is interesting. A working model was first made. From this the frame was laid out, the map scaled and the countries outlined. The vertical parts were next scaled and little pegs driven down for measuring the mountains. A clay map was then made on this frame and a cast taken, from which the plaster of Paris map (the one on display) was made. The next task was to shave the map and graduate it, after which the various parts were indicated and colored. At the same time the wiring system for the incandescent lights was installed. The scale of the map is one inch to every 7.8 miles. It shows the topographical detail of every battlefield.

An Electric Self-Winding Clock for the Automobile

WEAK-CURRENT electricity is interestingly applied in the self-winding mechanism of a clock which has been specially designed for the dashboard of the automobile. A simple electromagnet is made to drive the clock, and but three or four batteries are required.

In construction, this clock differs little from any other. The gears, however, are mounted to withstand the jolts of traveling. And instead of the ordinary hair-spring a straight helical spring furnishes the motive power. The armature of the electromagnet works much like that of a bell; it tightens up the driving-spring every time it is attracted to the magnet. The spring loosens up while running the clock, the armature swinging slowly back.



A simple bell-action attracts the armature and re-tightens the helical driving-spring whenever the watch runs down

It Always Turns Right-Side Up

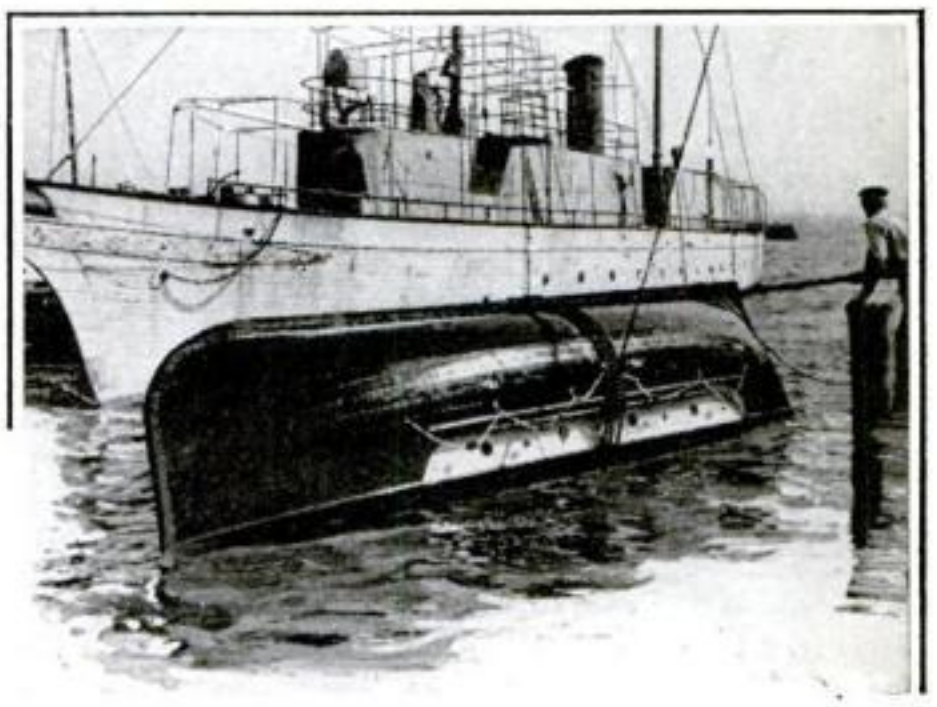
A boat which will carry twenty-five persons and will not "spill" even if turned upside down

THE chief objection to the ordinary type of life boat is the fact that almost no provision is made to protect the passengers from anything except actual drowning. Even here the protection is not complete, for in the heavy storms that so often cause the mother ship to be wrecked the little life boat is tossed about unmercifully, and its occupants sometimes swept overboard.

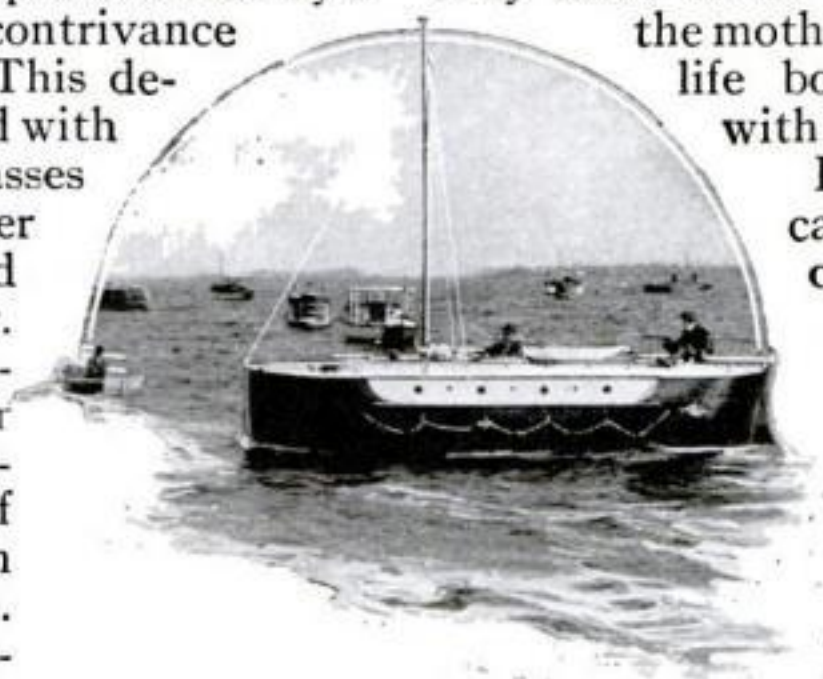
Mr. A. D. Newcomb, of Hampton, Va., has just perfected a life boat of entirely new design which is expected to meet this difficulty as well as several others. The Newcomb boat is completely closed, with manholes in the top by which to enter, and is water-tight. It might be supposed that it would necessarily be air-tight as well, thus depriving the passengers of oxygen, but ventilation is provided for by a particularly ingenious contrivance which admits air only. This device is a sort of valve fitted with a rubber ball. The air passes around the ball, but water causes it to float and thereby closes the opening.

Another ingenious feature is a water-tight oar lock. Oars are not furnished with some types of life boats, since it is foolish to attempt to row to shore. Nevertheless they are frequently valuable in guiding the boat to persons in the water. This oar lock is made as follows: A canvas sleeve is fastened tight around the oar at the point where it fits in the lock. The border of this sleeve contains a wire, and this in turn fits into a groove on an oval iron collar surrounding the opening, or port hole, through which the oar protrudes. When the sleeve is adjusted and the wire drawn tight no water can enter, yet the boat can be rowed with ease.

Perhaps the most useful device of all, however, is an arrangement for freeing the boat from davits and cradle by levers in the boat itself. Often, under the present method, the ropes are hopelessly tangled in the excitement of launching. Sometimes they have to be cut loose. And in case the mother ship sinks suddenly, the life boats tied on deck sink with her.



In a test made by the Department of Commerce the boat was rolled over. It righted itself without inconvenience to passengers



There is an offset on deck on each side of the turtle back. The boat weighs 2600 pounds

In this new boat all the cables are attached to semi-circular bolts which work on pivots. By pulling a lever one end of the bolt is released and the cables drop free.

The boat is twenty-six feet long, six feet four inches wide, and three feet four inches deep. The superstructure or turtle back is one foot eleven inches in height above the hull. There is a metal bulkhead at each end, each bulkhead having a 16 by 16 inch opening to be closed by a metal plate on rubber gaskets.

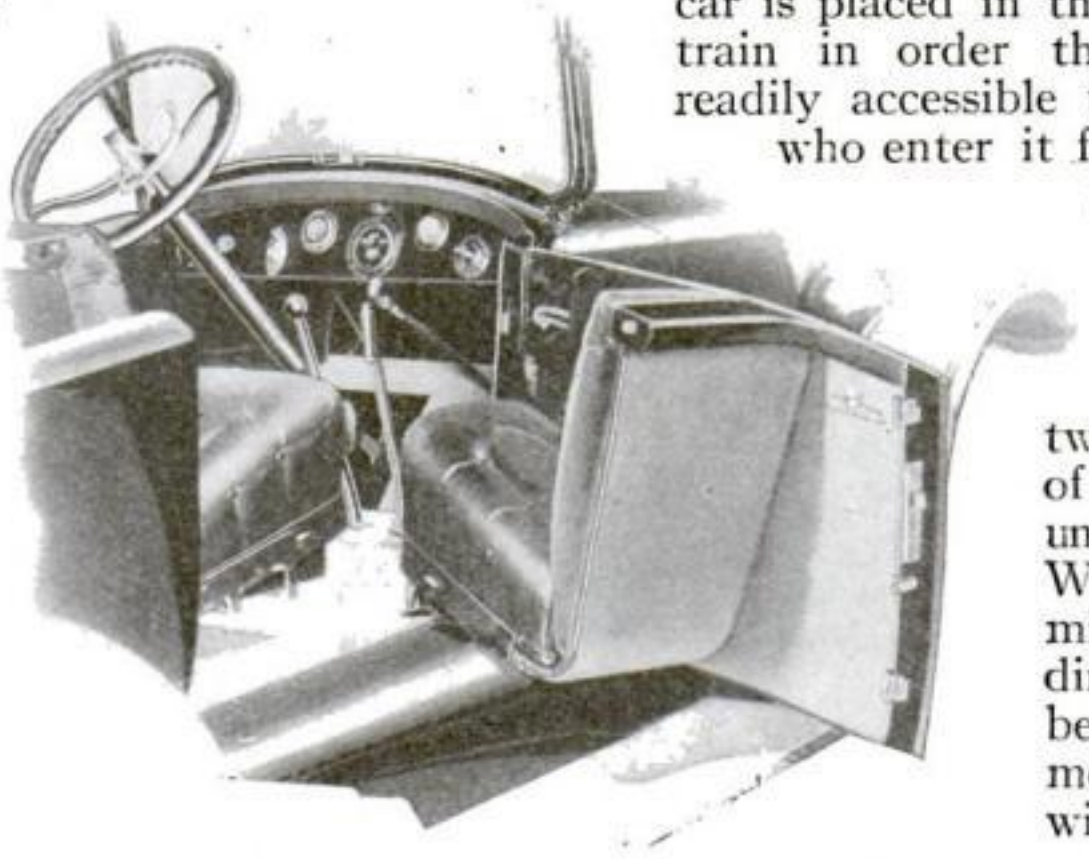
There are seven thwarts, seventeen inches high from the skin, or inside bottom of the boat. The oar locks fit into the three port-holes on each side. The three hatches or manholes on top of the superstructure are twenty-four inches in diameter, and are provided with rubber gaskets, each fastened with brass turn buckles and a safety lock.

The steamboat Inspection Service of the Department of Commerce, after testing the boat thoroughly recommended its adoption.

The Latest Device for Easy Entrance to Automobile Doors

THE last word in easy-entrance automobile doors permits direct entrance to both the front and rear seats of a close-coupled four-passenger roadster. The special feature of the design is the fact that one-half of the front seat opens with the door. When closed, the division in the seat appears as a fold in the upholstery.

The door may be opened from either the front or rear seat. It is provided with a safety lock to prevent its opening of its own accord while the car is in motion. It is hinged on two heavy concealed hinges at the front and runs in a track so that it cannot spring out of position.



One half of the front seat opens with the door, making easy entrance to front and rear

The Largest Traveling Kitchen in the World

THE ordinary dining-car, compact as a watch in its arrangement, can feed thirty persons at one sitting. The commissary car illustrated, which is the type used by Canada in transporting her troops, can feed 1,200 men at one sitting, and the food can be served in fifteen minutes.

The Canadian commissary car is the largest traveling kitchen in the world. It is eighty feet long, has a full-size hotel range, steam-cooking apparatus, and sixty-foot refrigerator space and store room capacity for tons of provisions. Eight cooks work in it without interfering with each other.

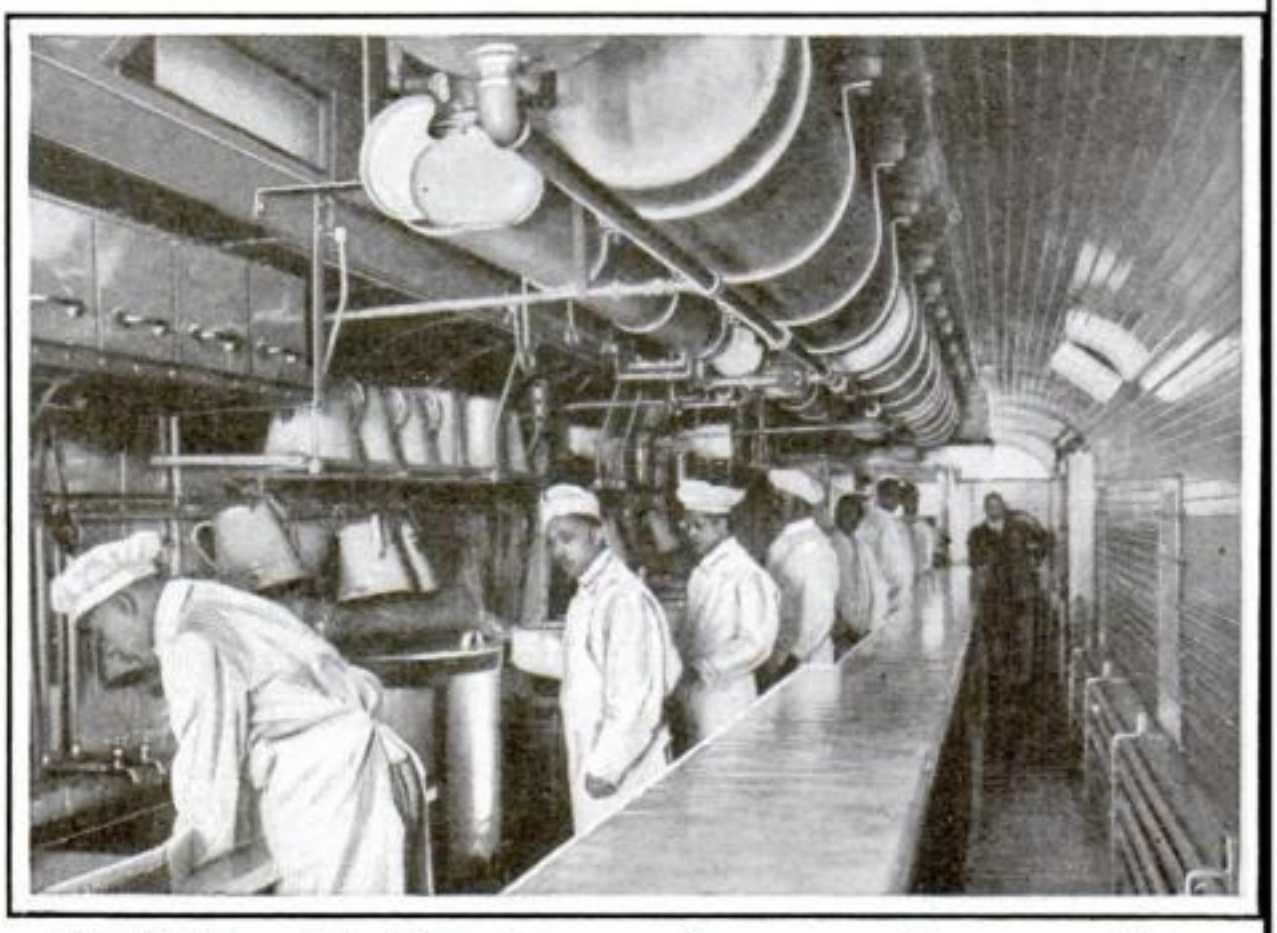
A battalion of 1,200 men en route from Camp Borden, Ontario, to Halifax, Nova Scotia, consumes:

4,000 lbs. meat	50 bags of potatoes
1,400 lbs. of sugar	100 lbs. of tea
1,200 lbs. beans	300 gals. of milk
1,500 loaves of bread	500 lbs. of butter
400 lbs. of coffee	600 lbs. of oatmeal

In the movement of a battalion, two commissary cars are used, the military special being run in two sections. The big dining-car is placed in the center of the train in order that it may be readily accessible to the waiters, who enter it from both front and rear.

As soon as the first two coaches have been supplied, two more squads of waiters arrive until all are served. Within fifteen minutes after the dinner bell has been sounded the men are all busy with their meal.

Along the wide kitchen counter are spread the various portions of food. If it is breakfast time and the morning menu calls for oatmeal, meats, potatoes, bread and butter, jam and coffee, the food is served about as follows:—Two men take the big trays of meats and potatoes, another the bread, coffee, and so on, until all the food has been carried away on the trays.



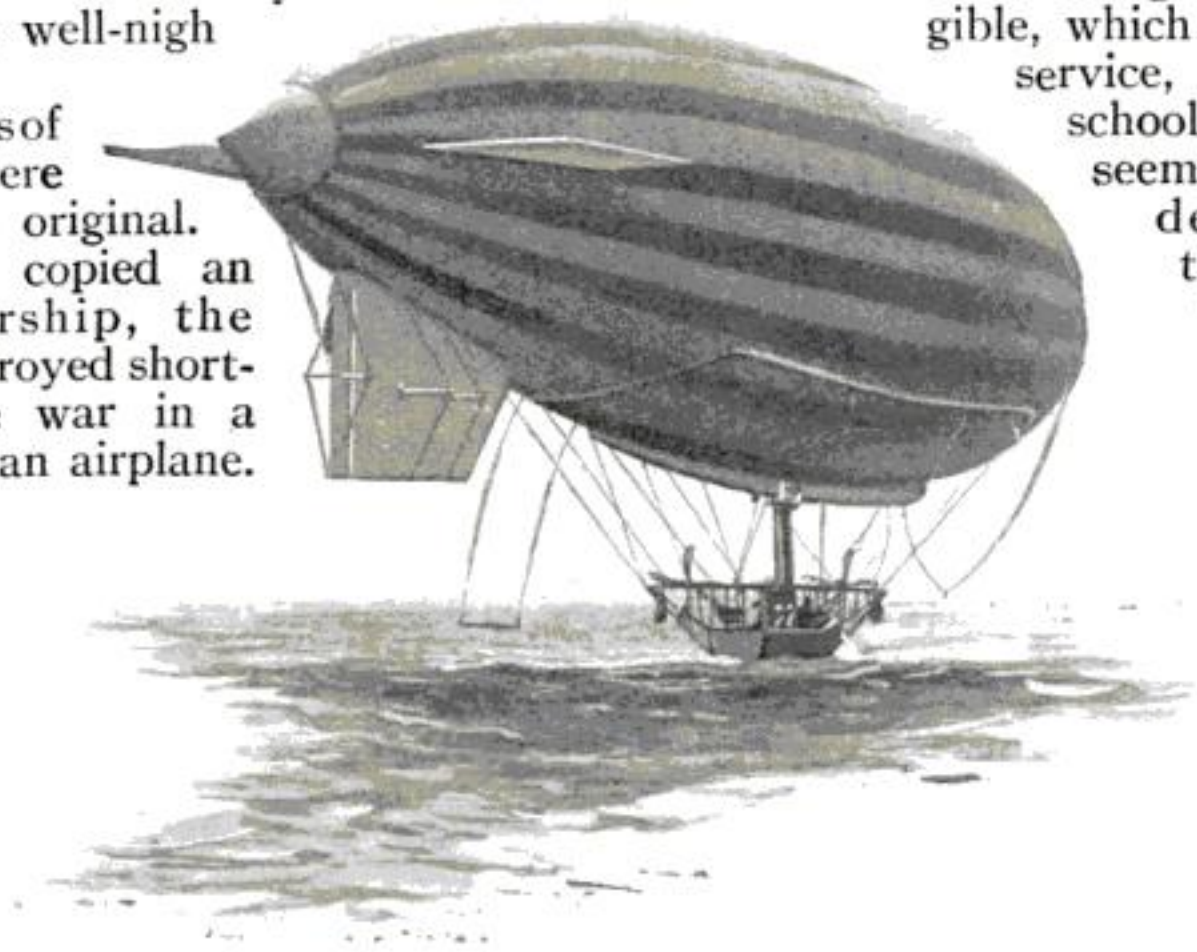
The kitchen of the Canadian commissary car. It accommodates eight cooks. Food for 1,200 men can be served in fifteen minutes

Old Before She Was Launched

There are styles in airships as well as in derby hats. The D. N. 1, our new navy schoolship-dirigible, is new and yet so old

TWO years ago, the United States Navy contracted for a small dirigible to serve as a schoolship. Now that the craft has been finished, now that it can be judged in the light of the European war, it must be wholeheartedly condemned as well-nigh useless.

The designers of the D. N. 1 were not daringly original. They simply copied an Austrian airship, the Koerting, destroyed shortly before the war in a collision with an airplane. A few features of some utterly useless British airships (designated by Greek letters *Alpha*, *Beta*, etc.) were incorporated.



© Int. Film Serv.

The D. N. 1, the navy schoolship-dirigible, is 175 feet long. It has a 140-HP engine to drive it at a speed of 25 miles an hour. Although new it is hopelessly antiquated

In the Koerting, the car was elongated fore and aft to receive front and rear suspension ropes. Thus the strain on the tender gas envelope was lessened. In the D. N. 1 that system of suspension is copied. The Koerting had two motors so that it was safeguarded to a certain extent against breakdowns; but the D. N. 1 must make the best of a single motor. The two propellers of the D. N. 1 are driven by bevel gearing, the arrangement being such that they can be swiveled. Hence, the craft can be pushed up or down by its propellers while it is making very little headway—a decided advantage in landing and starting. The D. N. 1 can be tethered by the nose of the gas envelope to a tall mast so as to ride out storms—a good idea because the ropes distribute the strain evenly over the envelope.

The Koerting was never regarded in Europe as a model to be followed. The D. N. 1 is worse than the Koerting. Its fuel capacity is sufficient only for two hours so that it may carry an apprentice crew of seven. Three or four apprentices would have been a more reasonable number.

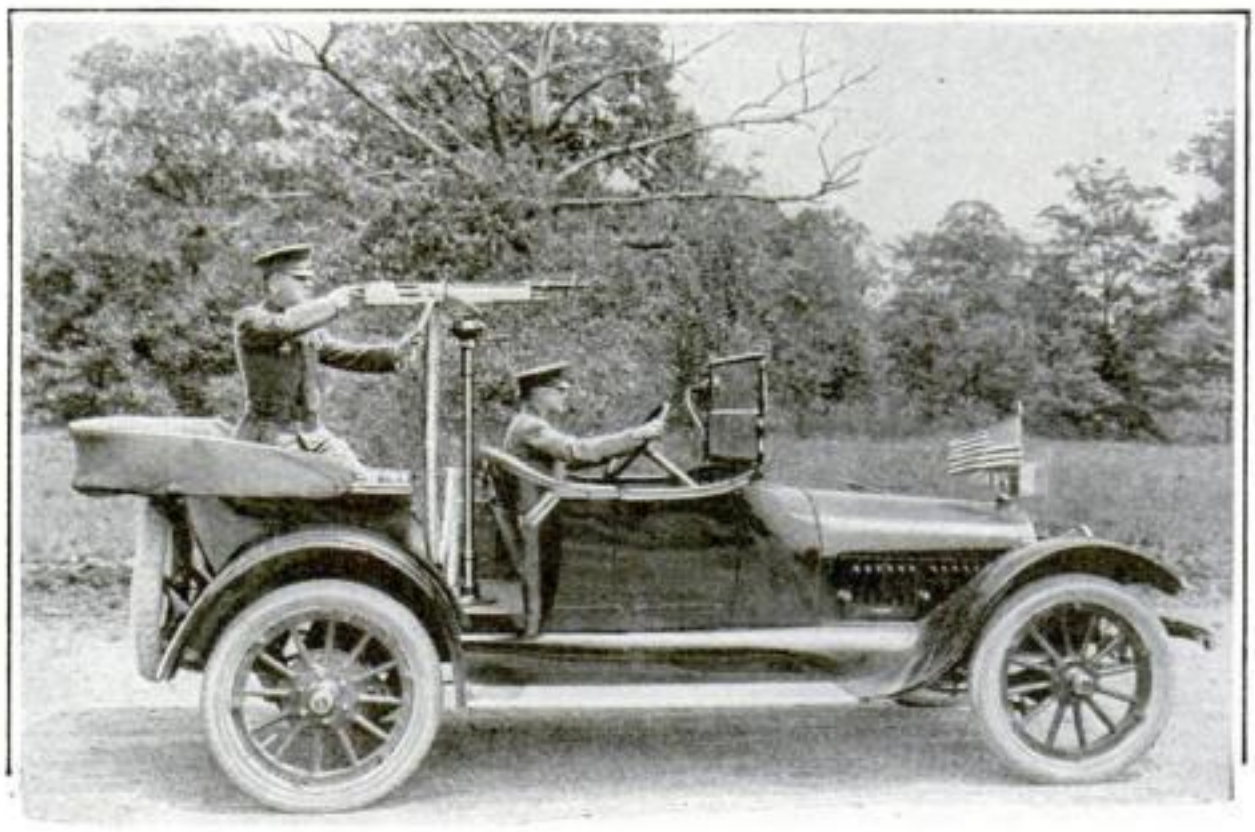
The whole idea of the D. N. 1 is fundamentally wrong. There may be some justification in degrading an old dirigible, which has seen active service, to the level of a schoolship, but there seems no excuse for designing an entirely new dirigible which is so slow that the experience to be gained in it is not even remotely similar to that required of the men in full-sized fast military or naval airships.

An airplane has what is called dynamic lift; that is, it rises by virtue of its own fast motion. A dirigible, too, has dynamic lift when it is fast. A slow dirigible has little or no dynamic lift. The whole science of piloting a dirigible is founded on the proper utilization of dynamic lift—a fact which we have learned in this country although the extensive German literature on the subject has harped on it constantly. In a dirigible of twenty-five miles an hour (the speed of the D. N. 1) little more can be learned than in an ordinary spherical balloon.

The faster the dirigible, the safer will it prove to be for an apprentice. Its dynamic lift makes it easy to overcome mistakes in managing gas and ballast. Moreover, a fast dirigible is not easily forced to land; and an enforced landing is the worst danger because no dirigible can come down anywhere in safety like a spherical balloon. Even the English *Alpha*, *Beta*, and *Gamma* ships have been discarded in favor of the "Blimps"—small dirigibles whose cars are wingless airplane bodies.

Turn It at Any Angle. It's Always Ready to Shoot

SEVERAL attempts have been made to mount machine guns on automobiles and motor boats. The principal problem to be confronted is that of vibration. In every case the inventors have devised several forms of mountings which would lessen to a considerable degree violent shocks. Needless to say, they have been hard put to it to devise a mounting that would stand up under the excessive vibration of a traveling automobile.



A machine-gun mounted on a ball and socket base fastened permanently to the floor of an automobile. It can be fired at any angle to straight up without changing or altering

The accompanying illustration shows a new mounting for a machine gun which enables the gun to be fired in any direction without changing the base. A ball and socket joint gives the greatest possible latitude of range, and the gun can be fired at any angle to straight up. The flanged base and about one foot of the supporting column are attached permanently to the automobile floor. The stand can be lifted off this base and put on another car, or by driving its pointed end into the earth it can be used for land firing.

A Giant Swing for the Summer Resort

INSPIRED by the swing 'neath the old apple tree, Frederick E. Happel, of Ballston, Virginia, has devised a giant swing for parks and recreation centers to thrill even the person who has grown tired of turning figure eights, riding down the roller coaster, and chuting the chutes.

Not only is Mr. Ballston's swing by far the largest ever devised, but it is so high that the starting platform has to be reached in an elevator. A steel car takes the place of the old pine board. From three to ten persons may be swung through space in the same car. The car is suspended not from a rope but from metal rods, preferably of steel. The tower which supports the swing is composed of steel pillars; so is the elevator building, as well as the elevator itself.

The swing chair or car is held in position on the starting platform by a locking device. When the car is ready to be released, a lever is operated which lets the car fall. The inventor does not tell us whether or not the car will return to the starting platform every time it is released. Neither does he explain how the car is brought back to the starting platform. Perhaps he figures that with a minimum of resistance it will return to the platform and thus be caught and held by the locking device without further trouble.

The giant swing is an overgrown edition of the old apple tree swing. It is made of steel

Two and a Half Miles a Minute

That's the speed at which a pitched ball travels

MR. FRANK B. GILBRETH, of Providence, R. I., who is known all over the world as an efficiency engineer and who has specialized in motion study, knows probably more about champions than any other living man—champion golf players, champion fencers, champion baseball players, champion handkerchief folders, champion surgeons and champion typewriters. In his effort to discover the fundamental laws of human motion, he studies every sport and every handicraft. But he studies with the camera—the motion-picture camera—not with the eye.

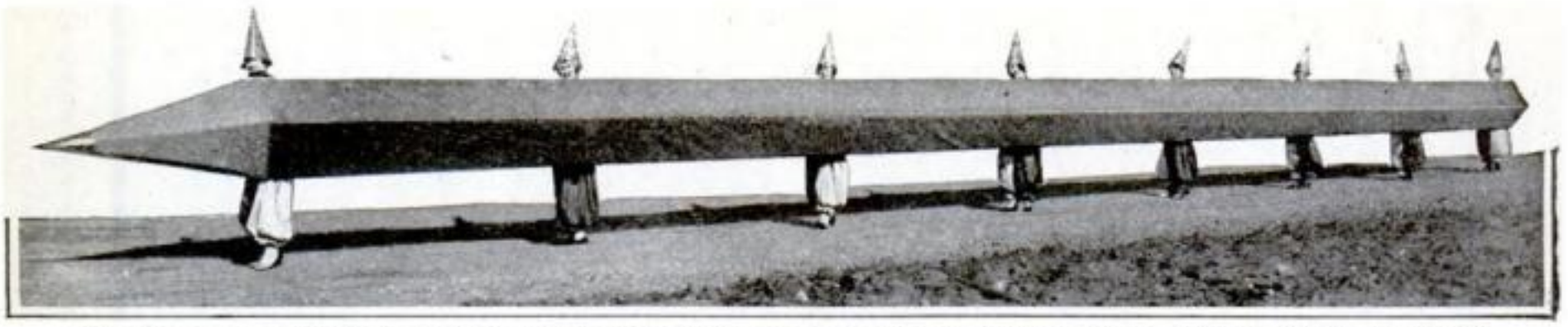
The clock and the background used in connection with motion pictures of a baseball's flight. In one of Mr. Gilbreth's tests, Fromme pitched a ball which, including the wind-up, required only .99 seconds until the batter hit it. The time consumed from the moment that it left the hand of the pitcher until it reached the bat was 0.288 seconds. The ball therefore traveled 210.07 feet a second, or 2 2-5 miles a minute. Even speeds of 2.8 miles have been recorded. In that case the batter occupied 0.042 seconds swinging and striking the ball; which means that he began his swing when the ball was 9.24 feet in front of him

Since it is necessary to know the time occupied in carrying out a given motion, sometimes to the thousandth of a second, and since camera cranks are never turned uniformly, Mr. Gilbreth has invented a special clock which is photographed with the scene. It is a very peculiar clock; for it has only one hand which makes six revolutions every second. That clock appears on every film and the position of its hand enables Mr. Gilbreth to determine the speed of a motion down to the one-millionth of an hour. Behind the catcher, a background is hung, ruled off into one foot squares. Every movement of the pitcher, catcher, batter, ball and bat is photographed against that background. Thus by referring to that background in the film the direction and extent of every motion can be accurately determined.

With White in the box, Mullaney catching, and Snodgrass at second, it required 4.407 seconds to pitch the ball (including the "wind-up") and to return it from the batter to second for a put-out. The actual time that elapsed from the moment that the ball left the hand of the pitcher to the moment when it dropped into the glove of the second baseman was 1.697 seconds. The actual time consumed from pitcher to catcher was 0.351 second—a rate of somewhat more than two miles a minute. The catcher recovered to launch the ball at second base in 0.317 seconds. It required only 0.796 seconds to throw the ball from catcher to second base—a distance of 129 feet. The record for a 100-yard dash is only 9 3-5 seconds. No wonder bases are difficult to steal.

Mr. Gilbreth's films are interesting in showing how long it takes a player to make up his mind what to do next. A baseball player must make quick decisions. A delay of a tenth of a second may be fatal.

Strange things are revealed by Mr. Gilbreth's camera. So swiftly does the ball travel that it is struck by the bat before the pitcher's foot has risen to its full height from the ground. Some pictures show the ball in the catcher's glove before the batter even began to strike. A baseball nine is a model of teamwork. And yet, even the New York baseball nine knows less about itself than does Mr. Gilbreth.



A gigantic pencil which when fully extended was seventy-five feet long. Eight of its "points" could not only write but talk. But it's a stingy pencil despite its length; it hasn't any eraser

Here Is a Pencil with Nine Good Points

AT a masquerade ball recently given in Oakland, California, by the advertising men of that city, there appeared eight girls standing in single file and wearing cone-shaped hats which resembled the points of pencils. They were enveloped in a clumsy, bag-like device which had a big point at the front end.

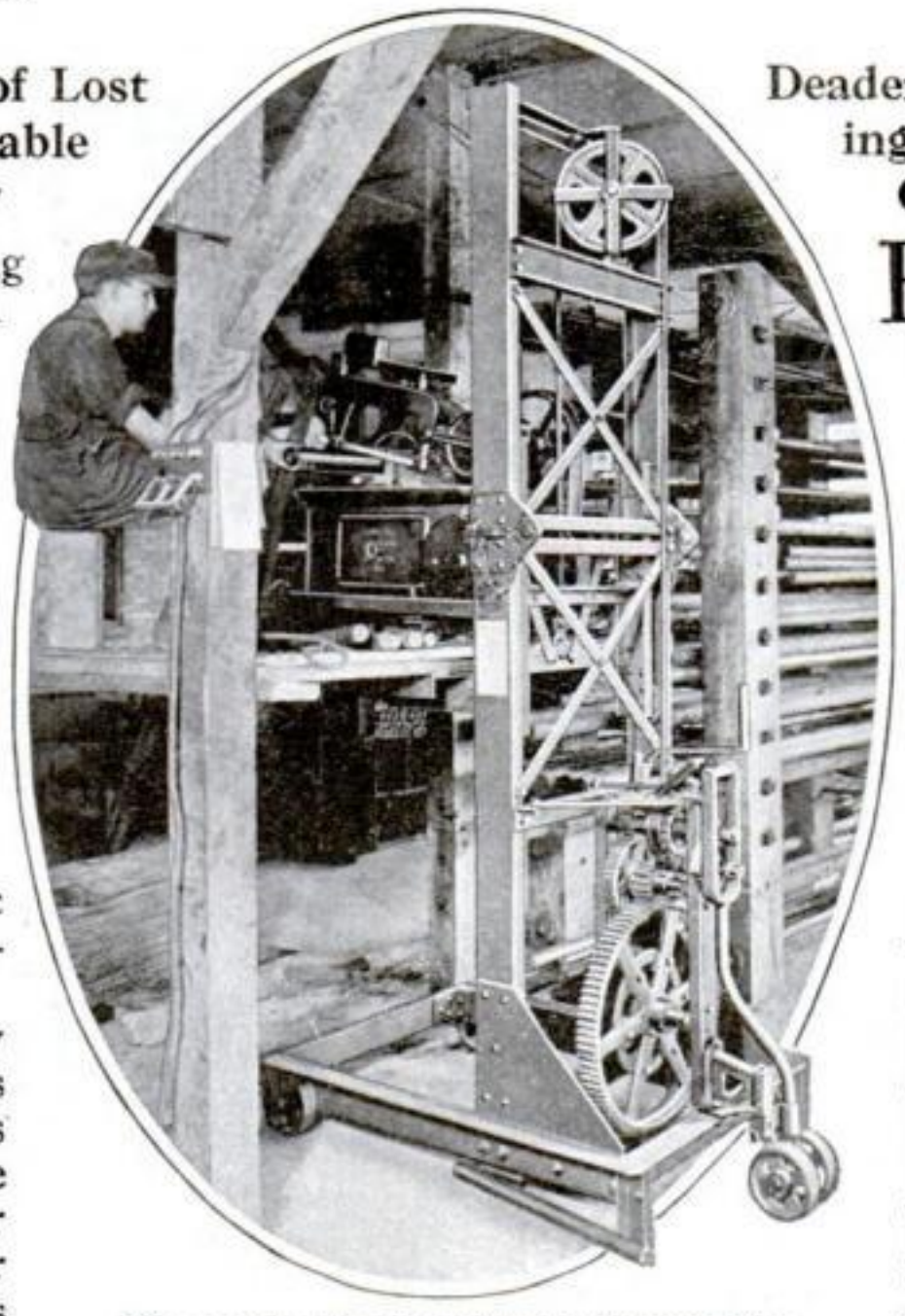
A signal being given, these girls stepped forward one by one. To the amazement of the on-lookers, they presented a gigantic pencil, seventy-five feet long and thirty inches in diameter. For once a pencil became longer with use.

The Latest Enemy of Lost Motion—the Portable Elevated Saw

IN all manufacturing plants using steel rods, considerable time and labor were formerly required to carry the heavy rods from their racks to the sawing machine and back again when short pieces were to be cut off. But thanks to a new portable elevator designed especially for carrying the electric saw, there is practically no loss at all.

When it is necessary to cut off short pieces of different diameters and shapes from the stock rods, the elevator is simply hauled over to the racks. By means of a system of reducing gears such as are used on all hand derricks, the elevator platform on which the electric saw is mounted can be easily raised up to the level of any rack. A rod on this rack has then to be moved a foot or two to feed it into the saw. In a few minutes the biggest rod is severed by the hack saw as it mechanically receives its rocking motion from the motor.

In order to cut other pieces of a different size, the platform is merely lowered in its guides to the level of the racks which contain the stocks of the proper diameters. It would ordinarily require six men to carry the heavy rods across the room, but by this means one operator can do it alone and in half the time.



The saw is simply raised or lowered to the racks containing the different sizes of stock. It takes the place of six men

Deadening Noise by Pasting Tar Paper on a Concrete Floor

BY pasting heavy tar paper to the concrete floor of a factory the thundering noise of passing trucks can be eliminated. The floor is first given a coating of gray cement paint and, when that is dry, a second coating is then applied. At the same time one side of a five-ply tar paper is painted and when both paper and floor are wet the paper is laid wet side down on the floor and rolled until all air-pockets disappear. This gives a tar-paper flooring which acting as a muffler, deadens all noise from trucks or heavy vehicles.

Putting Alcohol to Work on the Farm

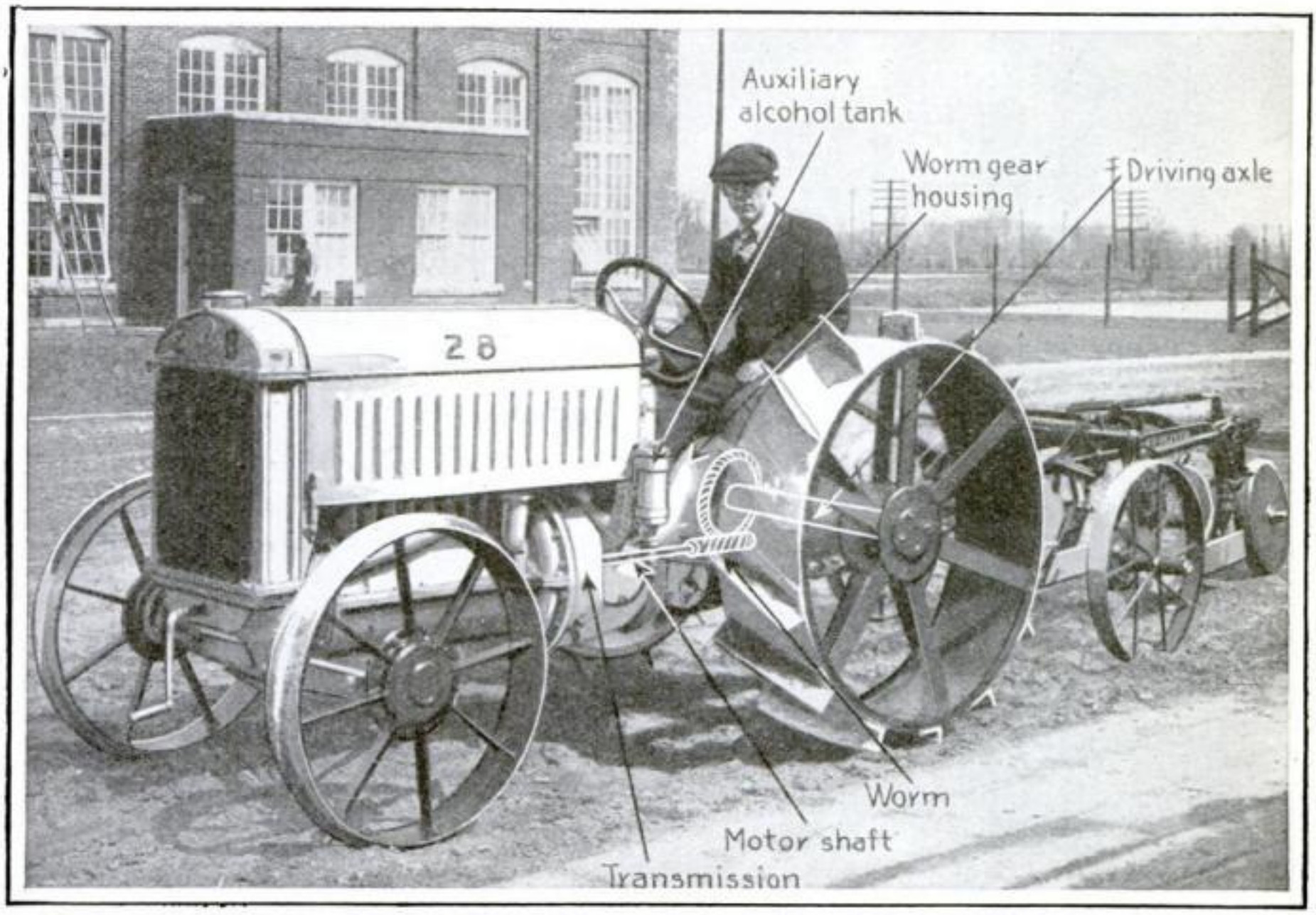
The stuff that destroys brawn and brain promises to be the inexhaustible fuel of the future

PROMISING to be on land what our great fleet of new steel ships will be to England on the seas, the Ford farm tractor shown in the accompanying illustration has been presented to the British government for use in raising England's crops during the coming season, even before a single one has been sold in this country.

Shortly after America's entrance into the war, Mr. Ford cabled the complete specifications to the British government and offered to build the parts for a thousand such tractors in a new plant in Cork, Ireland. Although this raised a storm of protest on the part of British agricultural machinery makers who were afraid that America would obtain a firm foothold in the British market, the plan is proceeding rapidly. It is expected that the simplicity and cheapness of the Ford Agrimotor will make it possible for this year's crop in England to be harvested more expeditiously than ever before, because of the ascendency of machinery over manual labor.

Besides the light weight and cheapness of the Ford tractor, its main characteristic is its ability to burn alcohol and kerosene with the same ease as gasoline. The supply of alcohol is as limitless and inexhaustible as the air and water, while the supply of gasoline and kerosene is growing smaller and smaller every year with no natural process of replacement that scientists can discover. Thus it may be that the havoc which alcohol has wrought in the past may be offset by the good it will accomplish when utilized as a fuel not only for farm tractors but for all forms of vehicles with internal-combustion engines. When that day dawns breweries will still be making alcohol but not for drink, and there will be motor cars in numbers beyond present belief.

The motor used on the tractor is exactly similar to that used on the present Ford passenger automobile, except that it is considerably larger and heavier.



The tractor which is run by alcohol. The motor is exactly similar to that used on the Ford automobile, except that it is larger and heavier. Kerosene can also be used as fuel

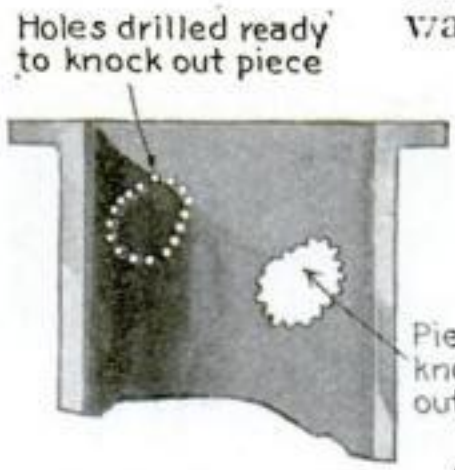
Death-Traps on German Liners

The harrowing task of investigating an interned German liner with the possibility of setting off a bomb or plunging into a pitfall at every turn

A corner flange on one of the circulating pumps and another on a steam chest were broken off with a sledge hammer

tomless chasm, and that, if you value your life, you must not touch a thing—wood, metal, or cloth—without first investigating it.

How would you like to explore such a ship with only a flashlight to guide you through the abysmal blackness, and with no means of communicating with friends on the top deck once you start on your perilous journey? This was the task assigned to a certain engineer in New York shortly after the Government seized the interned German ships in this country. It was a task fraught with the greatest danger, requiring an extraordinary degree of caution and patience, and calling for a rare display of courage. But so fearless was this young engineer and so successful was he in his undertaking that thirty-six hours after the ship in question reached the Navy Yard, the main boilers were generating steam.

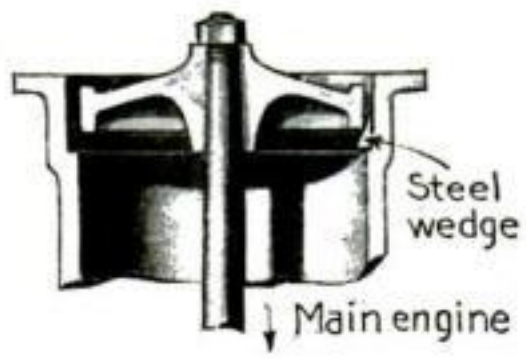


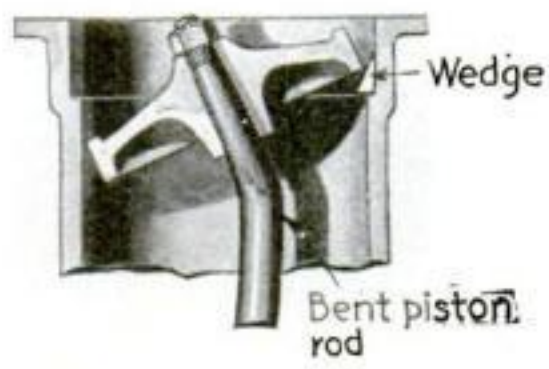
Cylinder walls were ruined by drilling holes and knocking out the portion within the holes

Among the many interesting things revealed by the intrepid investigator were the location of missing parts of

THINK of a great deserted ship, five hundred and forty-five feet long, seventy feet wide and over fifty feet deep—as black and forbidding as a Siberian copper mine, with not a ray of light from the uppermost deckhouse to the caverns of the lowest holds, in the damp and slimy bilges, or in the rooms filled with engines, pumps, dynamos, pipes and valves without number.

Think of exploring it, single-handed, with the warning fresh in your ears that it is full of pitfalls, bombs and death-traps; that every door you touch will set off an explosive which will blow you into eternity; that every ladder you step on will send you sprawling down a bot-





The steel wedge was driven in the cylinder head to break the piston and the stuffing box at one stroke. The engine was cranked over to cause the damage

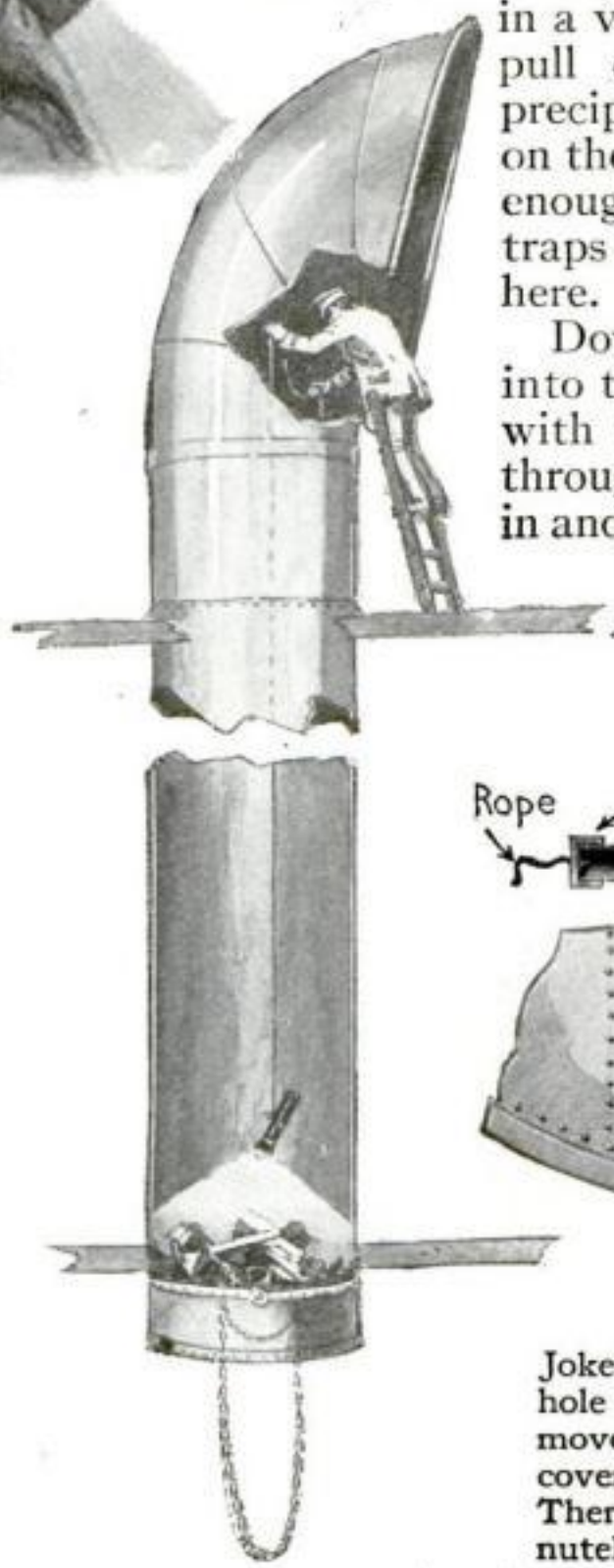
On one of the main engines a jackscrew was placed in the low pressure slide-valve chamber and a portion of the cover was broken out as shown above

the main engines, carefully hidden away in the coal bunkers; the discovery of bolts and nuts which led to a minute examination of the cylinders and steam-chests, where it was disclosed that parts had been removed and other parts carefully substituted to conceal the omission; the location, in other places, of studs and bolts partly sawed through, with the saw slot filled up; the finding of steel wedges fitted into steam-ports, so that any attempt to turn over the engine would have ruined it; the discovery of obstructions in pipes, smokestacks and ventilators—lumps of coal and bars of iron placed on top of the closed damper-valve in a ventilator, requiring only a pull on the damper-chain to precipitate the entire load down on the head of the person foolish enough to pull it, and other traps too numerous to mention here.

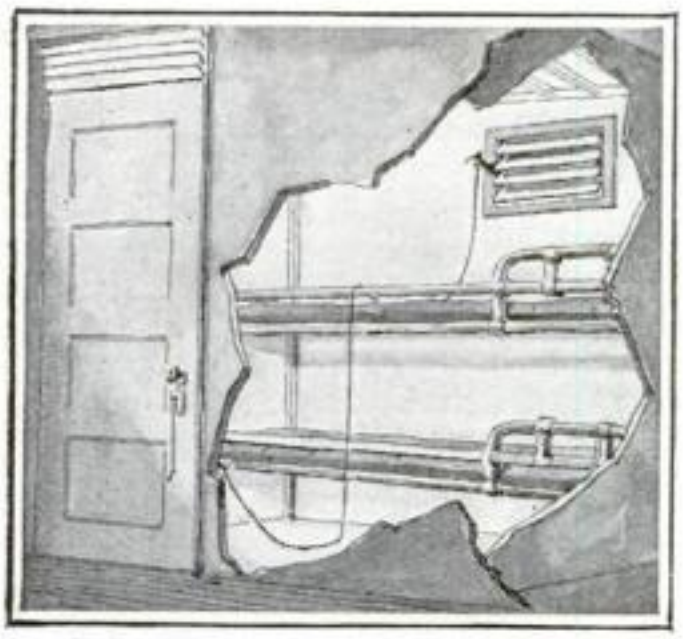
What would have happened had the damper-chain been pulled. Over one hundred pounds of iron and coal would have fallen on the unsuspecting person

Blueprints of the important details of the ship were concealed. They were tacked to the underside of bureau drawers and boxes. In cleaning out the drawers they were discovered

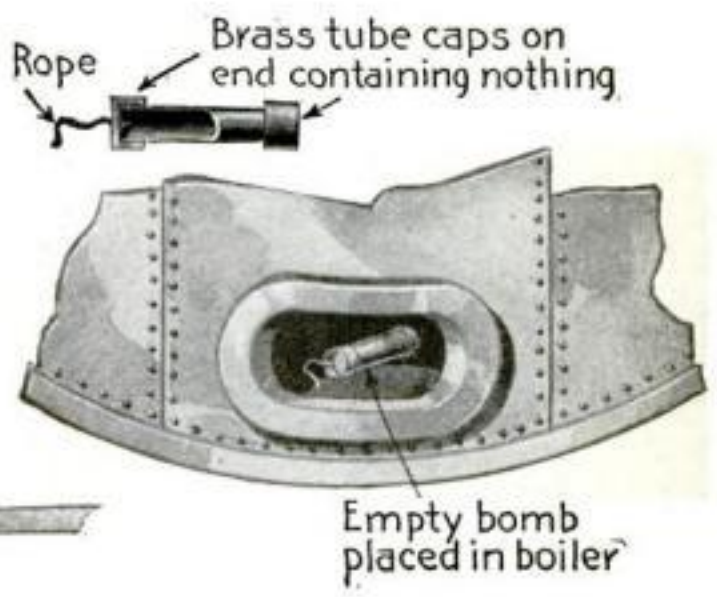
How the German trap on the *Friedrich der Grosse* was discovered by means of a flashlight and a bit of ingenuity. The light was lowered down the ventilator and its rays played on the iron and coal which had been placed on the damper to fall on the head of the person careless enough to pull the damper chain as shown in the picture above



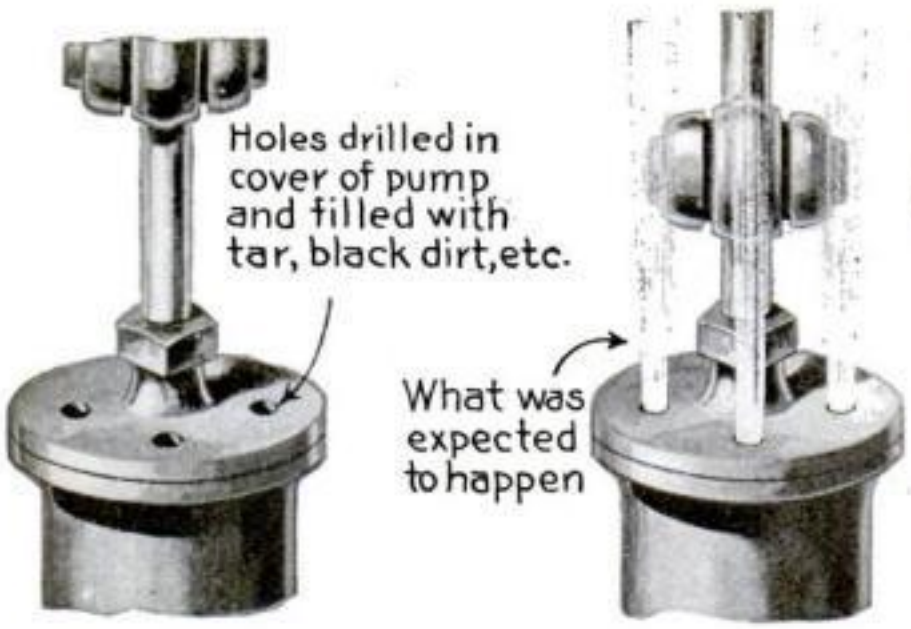
Down in the engine room and into the boilers, went the man with the flashlight, crawling in through one small manhole and in and out of the slimy tubes and shell, where one misstep would have meant serious injury. The long disused



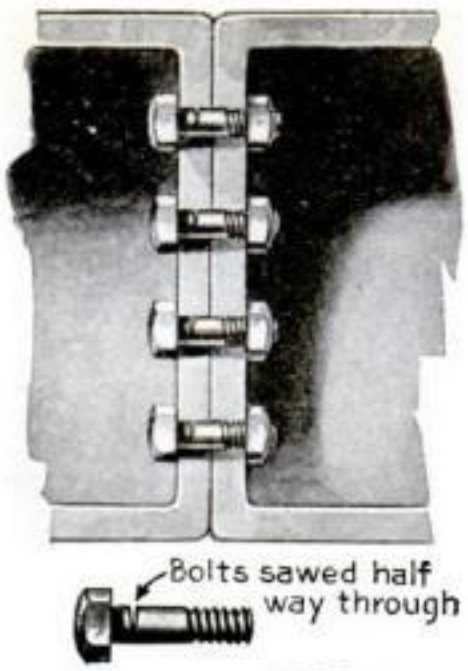
Joke No. 1. A device which was thought to be a death-dealing trap. The string enabled the occupant of the stateroom to open the ventilator without unlocking the door. What a relief!



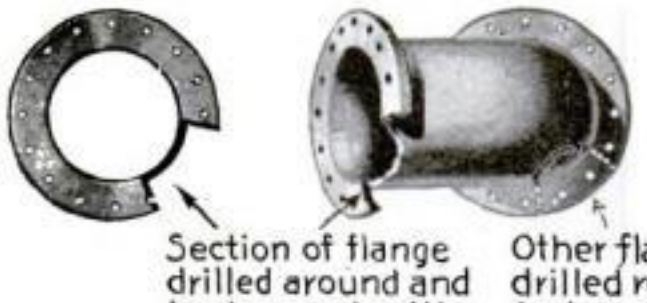
Joke No. 2. When the rear manhole plate of a boiler was removed a fake "bomb" was discovered in the position shown. Thereafter every boiler was minutely searched for a real one



Holes were drilled in the cylinder-heads of pumps, filled with dirt and then painted over, with the anticipated hope of giving someone an unexpected bath had the pumps been started before the holes were discovered

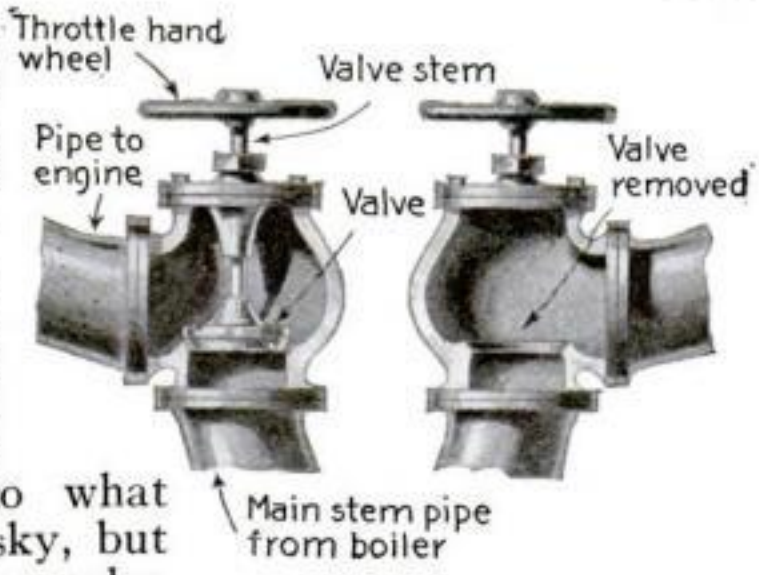


Small bolts holding together the lagging of steam connections were sawed half through and then replaced. Had the steam chests been under pressure the bolts would have broken and an explosion would have taken place



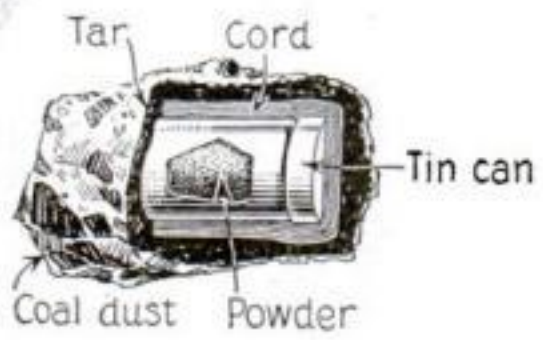
Broken flanges on main steam elbows. The sections were first drilled around and then broken out with sledge hammers

fire-room came next, every nook receiving the closest scrutiny. Then came a trip through the furnaces, the combustion chambers beyond, the grimy uptakes and the long and tortuous connections of the great smokestacks and up their sooty ladders to what should have been the sky, but what proved to be heavy wooden covers fastened across the stacks, all carefully concealed from view.



At left: The main throttle valves had been removed and destroyed, leaving only the empty valve bodies

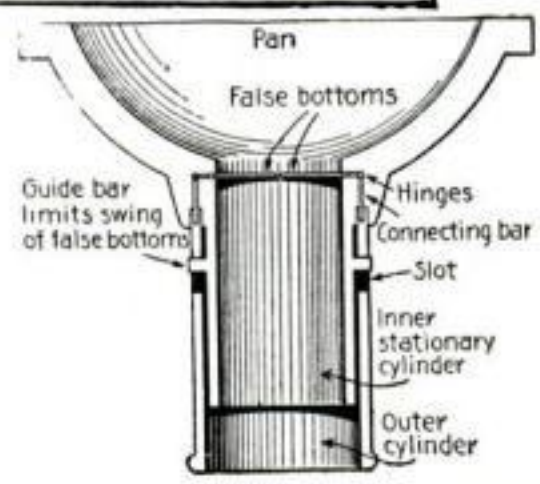
This task done, the engine room was reinspected, to locate the pipes and valves. Next in turn were the enormous bunkers, tanks, water-tight doors and bulkheads, reaching from one end of the ship to the other, from the highest deck down to the bottom-most chamber of the hold. What would have happened had the flashlight gone out? Would the man have found his way out again?



Twenty-four bombs were found in the coal bunkers. Is it any wonder the coal was screened four times? The bombs were simply tin-boxes wrapped with twine. After they were dipped in tar and rolled in coal dust they were placed with the coal. Each bomb was found to contain a high explosive

Getting Your Change by Machine From the Cashier

IN busy stores and restaurants of the pay-at-the-desk variety, a new device for handing change back to the customers is proving popular. You simply hand in the check and the money through the cashier's window. When she has made the change she deposits it in the opening of a cylinder, as shown in the illustration. By giving a slight upward push on the bottom of the cylinder you cause the two halves of the false bottom of the cylinder to open out, and the coin drops down into your palm. Or you can obtain your change in the usual way, by sliding it off the opening of the cylinder into your hand. Of course the device will not work with bills or soda checks.



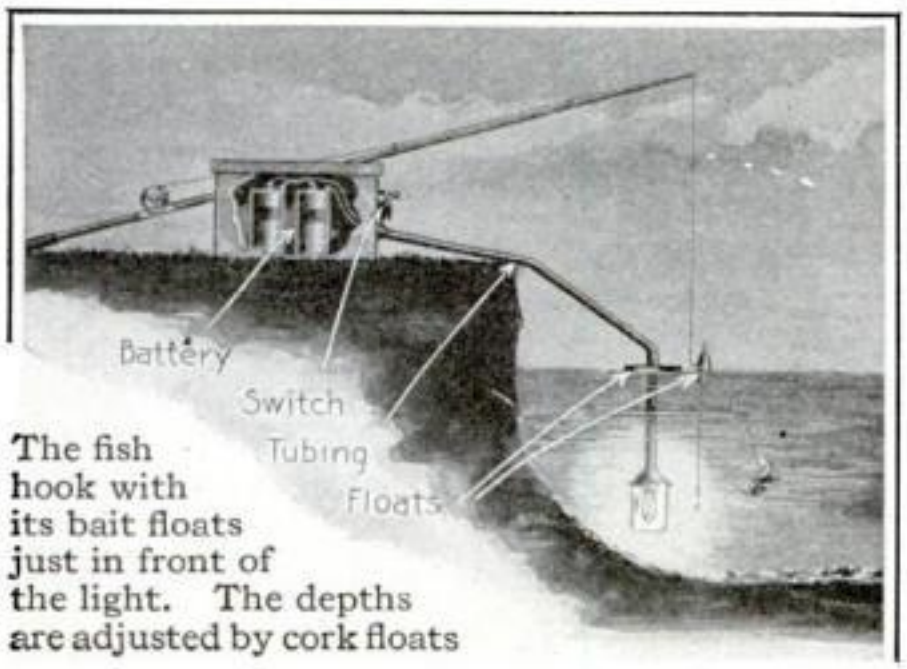
Above: The coin-dropping device in operation. At right: The device in detail

A Fishing Light to Lure the Fish to the Bait

WE have the word of the fishermen for it that fish are not unlike other creatures of the earth in regard to curiosity. They are as interested in what goes on below sea level in their subterranean home as we are in what takes place above it.

William J. Ryan, of Sapulpa, Oklahoma, has made good use of this bit of fish psychology in devising his fishing apparatus. He suspends an electric light and a fish hook near each other under the water. The fish are attracted to the light like moths to a flame. Near the light they see the bait, investigate, and then repent when they find themselves on land.

Within a wooden box large enough to hold the entire apparatus the inventor places two batteries. Wires run from these batteries to a lamp which is suspended in the water. Rubber tubing around the wire keeps out the water, and so does a glass jar about the lamp. The depth of the light and the hook in the water is adjusted by cork floats. Needless to say, the brighter the light the more curious and careless are the fish, all of which delights the fisherman.



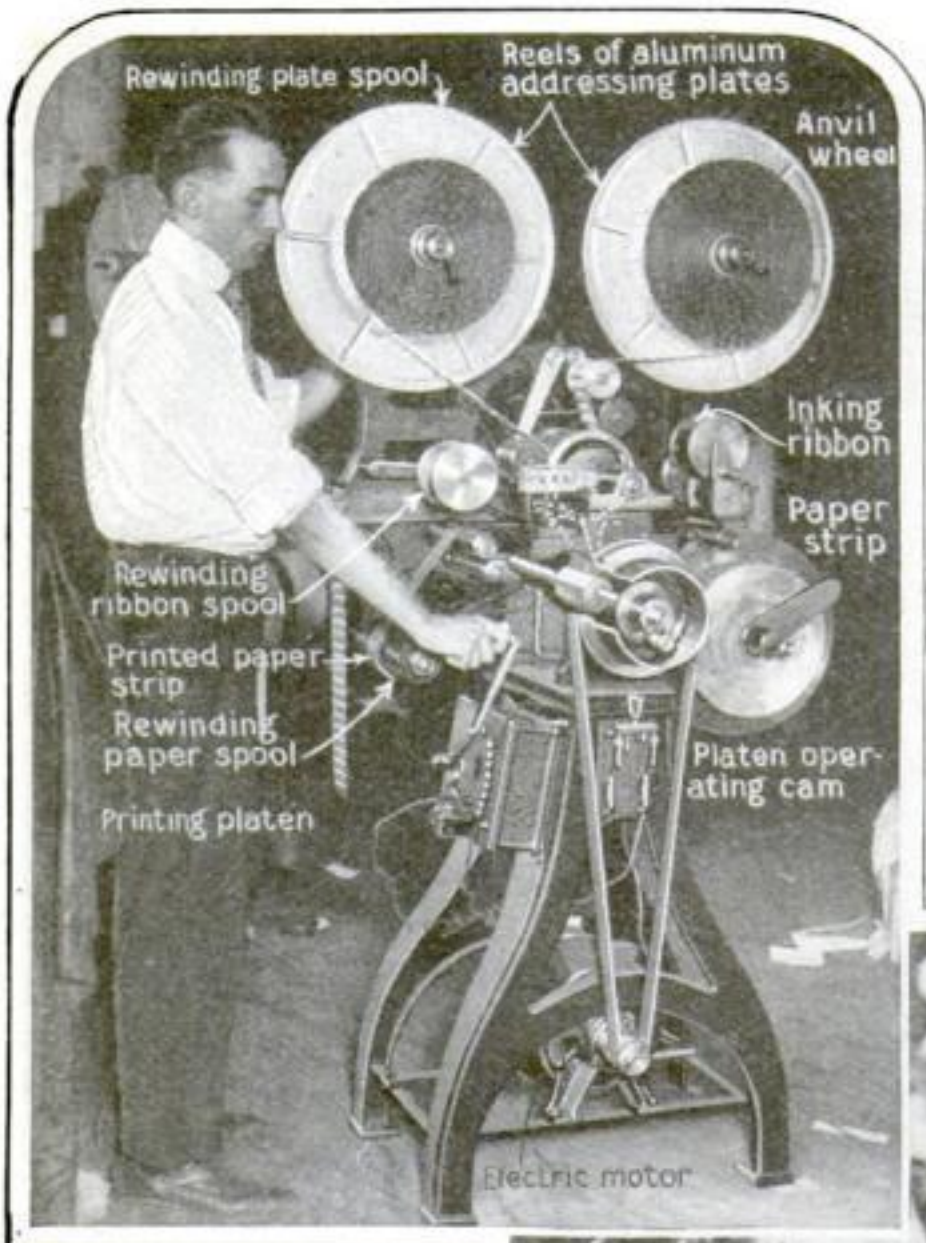
The fish hook with its bait floats just in front of the light. The depths are adjusted by cork floats

It Costs a Fortune to Keep French Army Officers in Cars

JOY riding seems to be a regular sport of French army officers. According to charges of reckless extravagance made against the touring-car section of the French army, the officers think that the cars they use are their own private property. Indeed, competition is rampant, each officer wanting the best machine and the most expensive assortment of accessories, says the report. The cost of twenty-six cars for the general headquarters staff cost one hundred and seventy thousand dollars. Three thousand dollars is the annual upkeep per car. The only remedy, as France now sees it, is to refuse to allow any officer, no matter what his rank, to have a personal car.

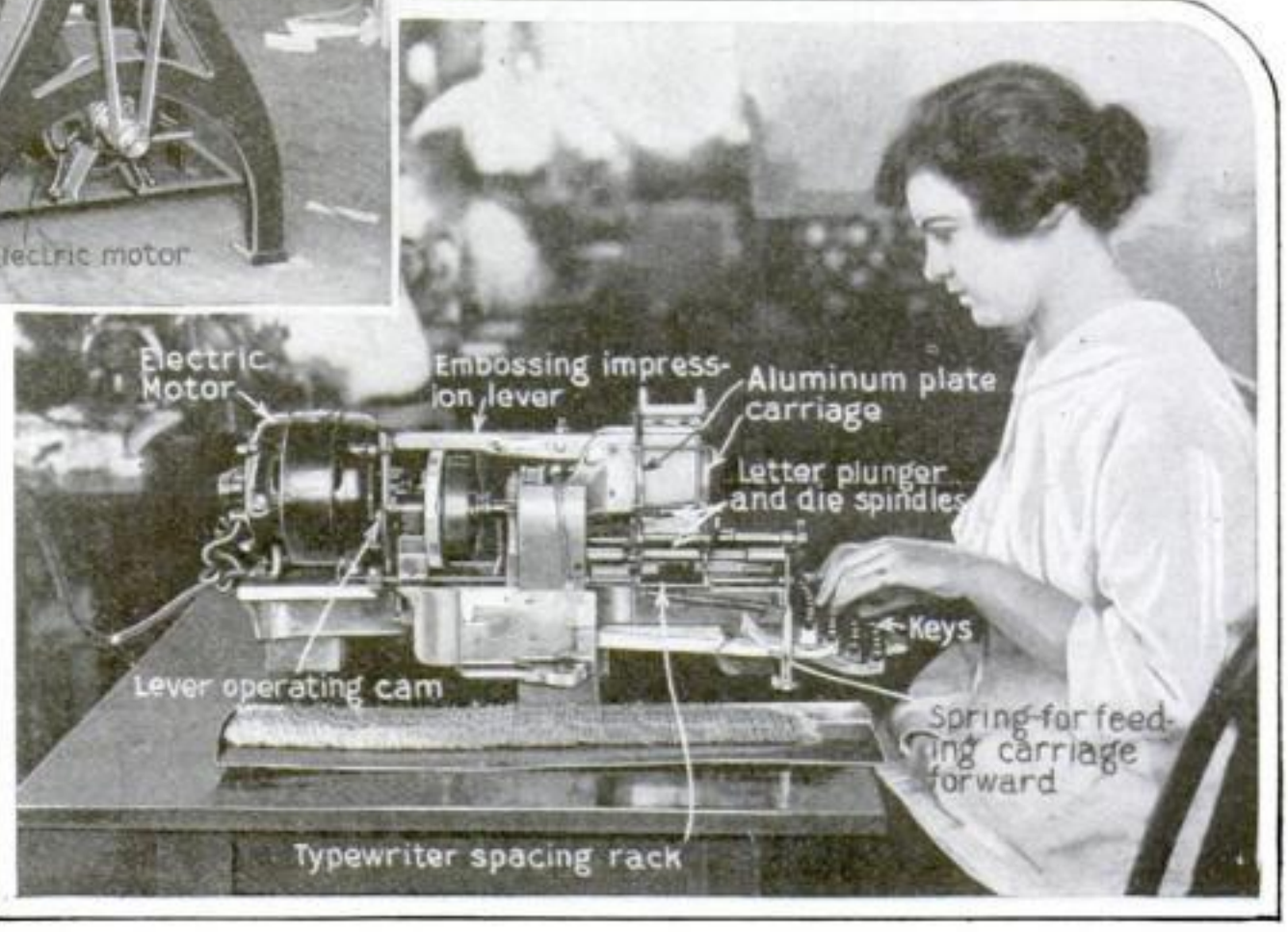
Addressing Newspapers by the Thousands

The lightning-quick method by which the news reaches the subscriber before it grows "stale"



A motor-driven typewriter embosses the subscribers' names and addresses on aluminum plates

Reels of the aluminum plates are run through the press, printing as many as thirty thousand names an hour



CHEAPER and quicker than the lead-type methods of printing the addresses on newspapers, is the new system which uses embossed aluminum plates. The addressing of daily newspapers by the former method was a tedious task. Now the same task can be done by machinery with the saving of half the expense and of considerably more time.

Instead of using a printing press to mark each address individually, the new system employs a reel of embossed aluminum plates which print the addresses continuously. The string of aluminum plates is run at rapid speed under a wheel anvil. A stamping plate underneath presses the paper mailing-strip and the inking ribbon against the embossed plates round the wheel anvil, thus printing one address as each plate rushes by. The result is that thirty thousand names can be printed on the paper strip in one hour.

A motor-driven typewriter is used to emboss the names and addresses on the aluminum plates. When a key is pressed, two lever arms are operated instead of the one on an ordinary typewriter. The motor at the same time presses the corresponding letter plunger and die through the plate, embossing the letter upon it. After several thousands of these plates are embossed, they are all built up into a huge reel by simply catching the hinges together on their ends.

After a long mailing strip has been printed, the modern newspaper office runs it through a cutting machine. Here the printed names and addresses are separated and then pasted upon the newspapers, all automatically.

It takes methods such as these for a great newspaper to reach its patrons daily before its news becomes "stale."

The Open-Air Barber Shop Where the Prices Fit a Beggar's Pocket

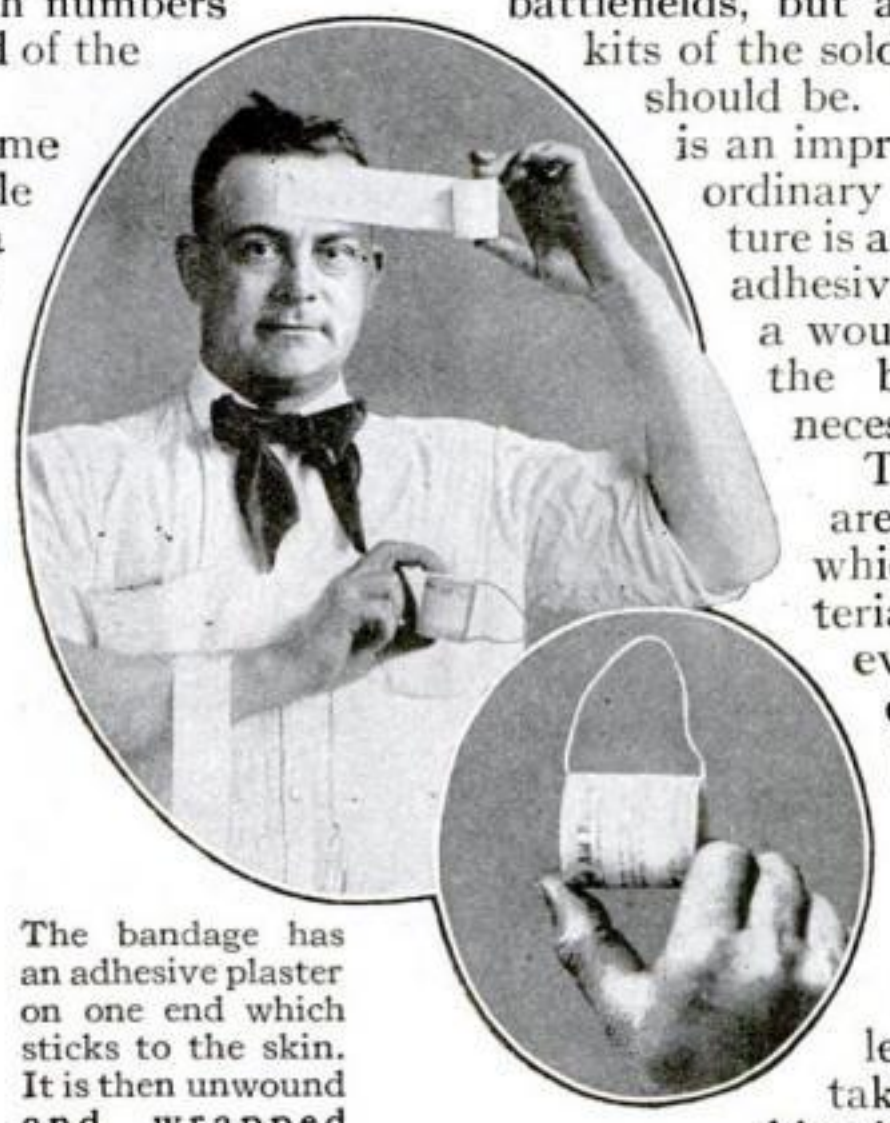
IN Paramaribo, capital of Dutch Guiana, South America, are many East Indian coolies who have been imported under a system of indenture in such numbers that they comprise one-third of the entire population.

Now, since through some tenet of their unfathomable religion, the wearing of a beard is not permitted except by the very aged or by dignitaries, the coolie must needs shave continually. Even the tramps and beggars must keep their faces clean-shaven and their hair cropped. Naturally the proprietors of our barber shops do not care to accommodate the class of patron seen in the photograph below. But the itinerant barber has no such prejudice. He has no overhead expense to meet, such as would be entailed by a shop, so that his prices can suit even the beggars.

The traveling barber locates his shop wherever there is a group of squatting coolies to be shaved

A Wounded Man Can Dress His Own Wounds with This Bandage

THE rolled bandage is in great demand. Not only in the hospitals and in the equipment of the doctors and nurses on the battlefields, but also in the comfort kits of the soldiers it is found—or should be. The one illustrated is an improvement on that in ordinary use. Its chief feature is an outer end which is adhesive and which enables a wounded man to apply the bandage himself if necessary.



The bandage has an adhesive plaster on one end which sticks to the skin. It is then unwound and wrapped

The ends of the roll are coated with wax, which keeps the material from unrolling, even if the bandage is dropped. This also prevents it from getting soiled when carried in the pockets. To apply the bandage, a man injured in the left arm, for instance, takes the package in his right hand, and the loop, shown in the photograph, in his teeth.

Olive Oil Can Be Utilized to Prevent Fog at Sea

OIL, though long known to be effective in calming a sea, has only recently been proved of value in preventing fog. Air is prevented from coming in direct contact with water which is warmer than the air. Thus condensation of water vapor is hindered.

It has been found that olive oil when spread out over a calm sea will begin immediately to lift the fog. "Grass islands" entirely obscured by the fog bank at only a few yards have been discerned as far away as a mile, in line with the clearing made by the oil.

Wind, of course, tends to counteract the effect of the oil, except in the direction in which it is blowing.

Those of us interested in science, engineering, invention form a kind of guild. We should help one another. The editor of The POPULAR SCIENCE MONTHLY is willing to answer questions.

Inclined platforms leading to the roof of the goat-house were built to indulge the climbing instincts of the goats

Wild Goats Live on the Roof of Their Building

THE efforts of wild animals in captivity to follow their natural instincts were amusingly illustrated recently by the antics of some wild goats in a Western Zoological Park.

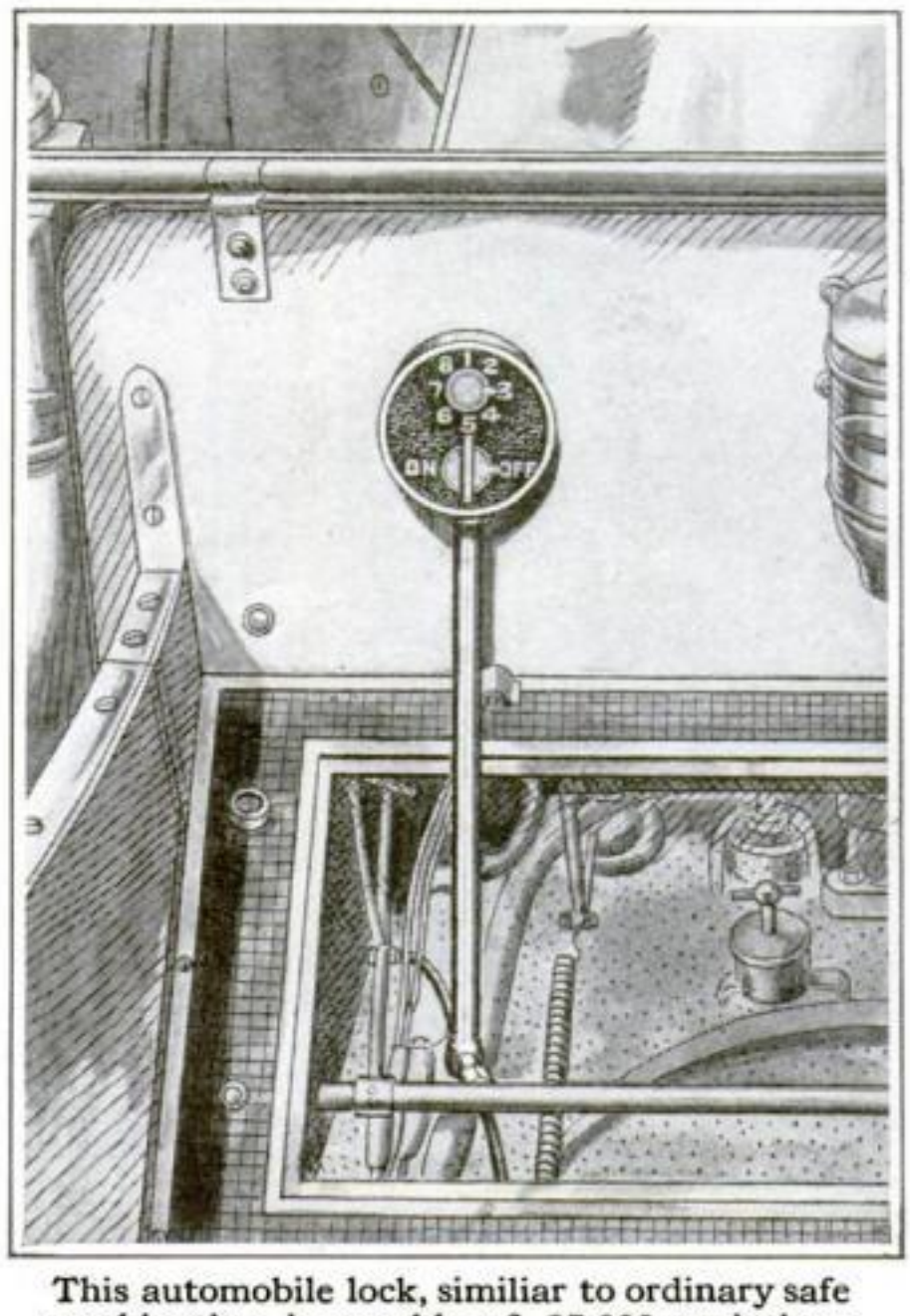
Six of the goats were captured and a loghouse, surrounded by a high wire fence, was specially constructed for them in the zoological park. For a long time, however, they were ill at ease and made desperate efforts to scale the wire fence. Finding this impossible, they finally attempted to climb up the sides of their log house. This taught their keeper that they were not trying to escape but were merely following their instinct for climbing. So he built inclined platforms leading to the roof of the building. As soon as these were finished the goats scampered to the roof, evidently enjoying themselves.

If You Use This Lock, Don't Forget the Combination

A NEW lock for the automobile works on a simplified form of the combination principle commonly used in safes. By a combination lock the self-starter, battery and magneto circuits are connected and disconnected within a steel case on the instrument board. With the same operation a valve in the gasoline lead is opened and closed by means of a steel wire in metal housing extending from the lock on the instrument board to a valve which is located in the gasoline lead.

When the driver wants to lock his car he gives the operating handle, mounted just below the combination knob, a half turn to the off position and all ignition is instantly disconnected and the gasoline cut off.

When the driver wants to unlock his car he simply turns the combination knob to the three-number combination he has set and all the ignition is connected and the gasoline valve opened.



This automobile lock, similiar to ordinary safe combination, is capable of 87,000 variations

The lock is capable of more than 87,000 distinct changes in the combination, so that it would waste time for even an expert to find the right one unless he knew it in advance.

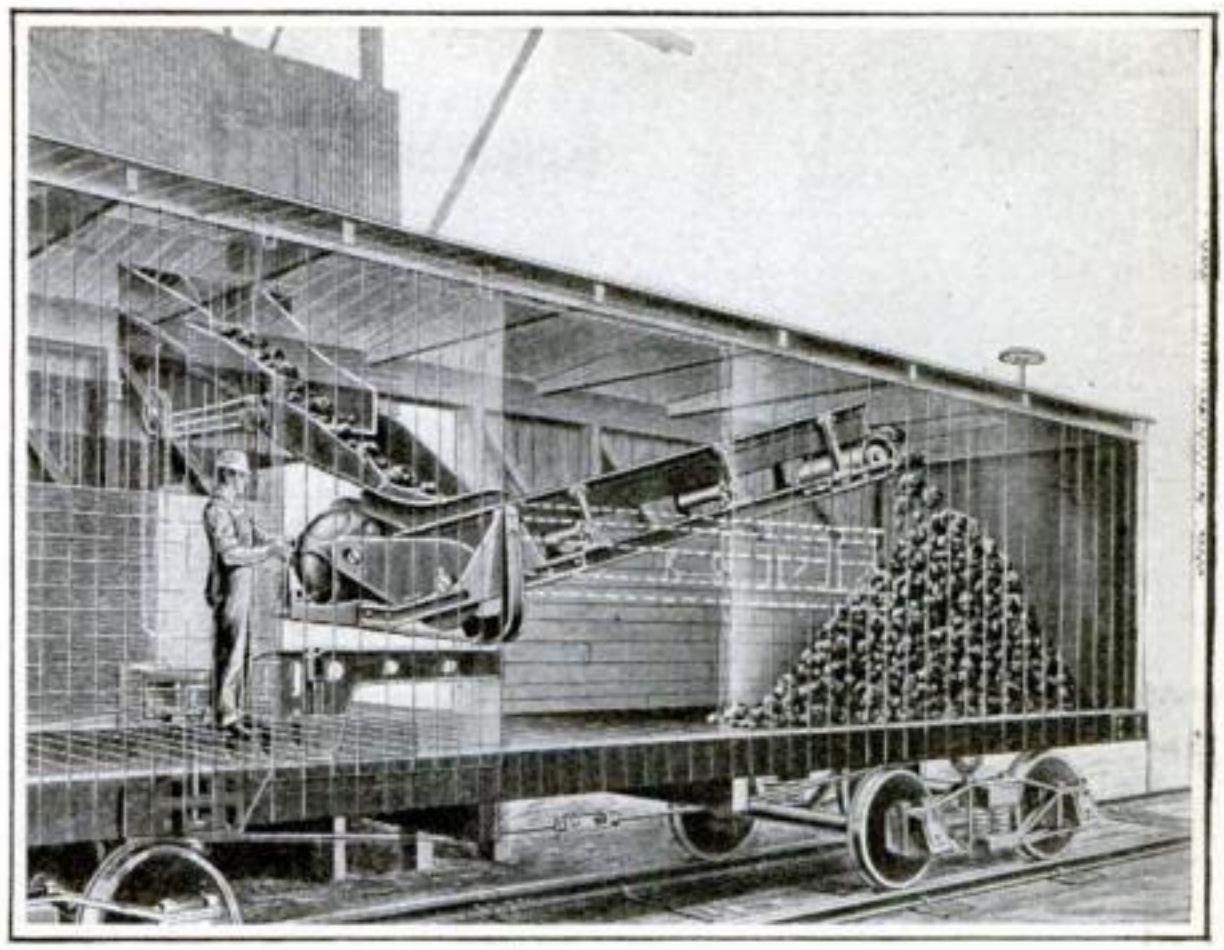
When a car is locked there is no loss of gasoline through dripping, for there is no pressure on the carbureter. The lock also prevents "backfire" setting a car afire; for when "backfire" occurs you simply turn the lock off and the carbureter is disconnected.

The Policeman and the Fainting Lady

WASHINGTON police, experienced in handling big crowds at presidential inaugurations and other celebrations in the national Capital, recently set about to find a way to revive persons who have fainted on the street without having to call an ambulance and send them to a hospital. Now every member of the force when on duty in crowds carries in his pocket a pill-box full of tiny glass tubes of aromatic spirits of ammonia. The tubes are about an inch long and slightly more than an eighth of an inch in diameter. Each has a wrapping of absorbent cotton and over this a silk gauze covering.

Slight pressure between the fingers is sufficient to break the tube. The ammonia is promptly absorbed by the cotton about it, which also serves to prevent the sharp particles of glass from doing any harm. Held beneath the nose of the person who has fainted, the fumes of the ammonia soon revive him. The tubes are stored in all the patrol boxes about the city and are carried in patrol wagons and police ambulances.

Reviving a fainting person with aromatic ammonia carried in tiny tubes, as in circle



The conveyer reaches eighteen feet into the box car and piles the coal in the far end of the car without breaking it

A Conveyer Which Loads Coal in Box Cars Without Breakage

IT is difficult enough to bring coal to the surface, but marketing it in good-sized lumps is a still harder problem. If the coal leaves the mine in large lumps and is delivered in small lumps, having been broken in freight cars on the trip, it suffers a depreciation in price of about thirty per cent. This is one of the discouraging factors that the shippers of coal have had to contend with for years.

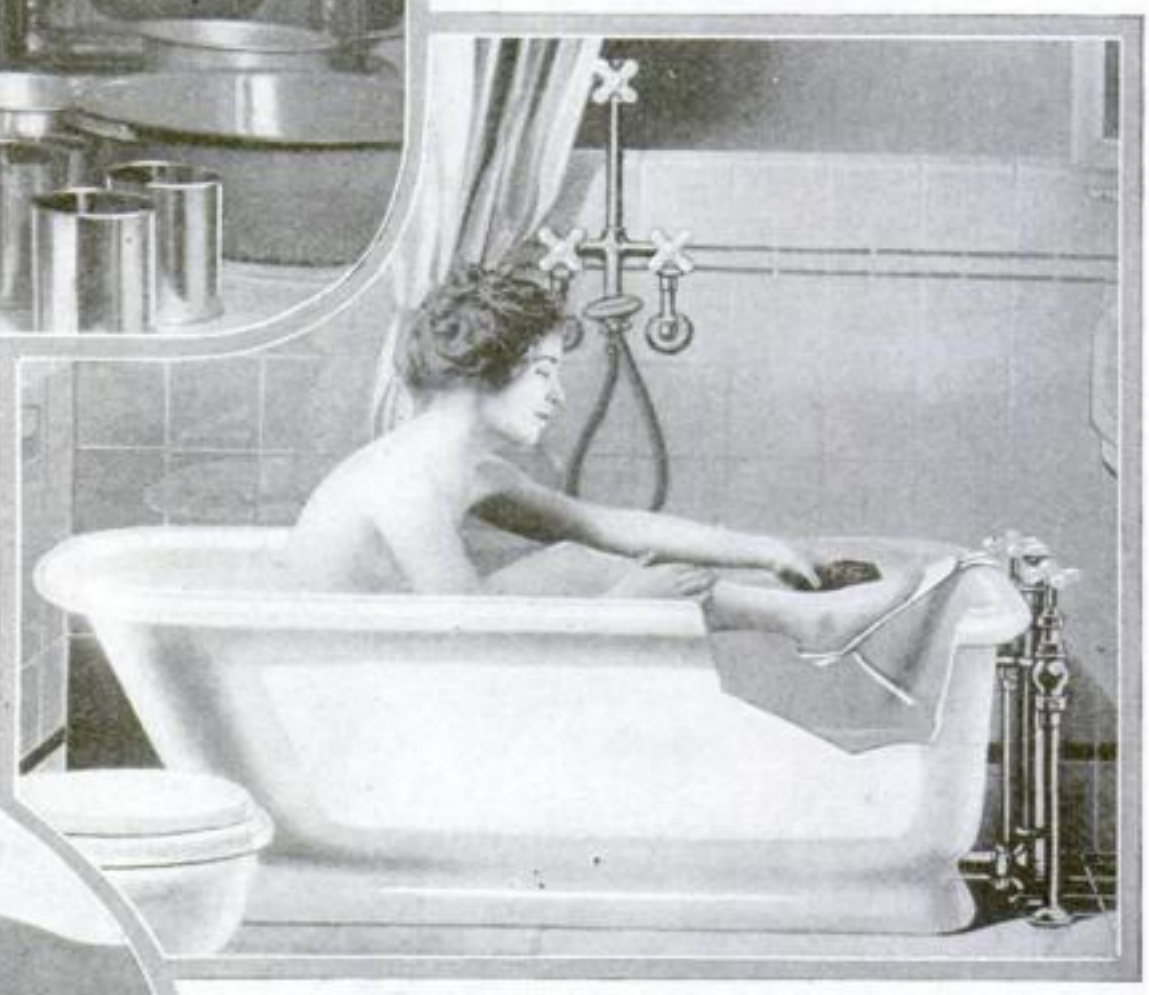
Box-car loaders of various kinds have been used with little success. Mechanical shovelers disposed of the coal in short order, but they broke it badly. Now comes the conveyer type of loader, designed to load the coal without breakage. It does not throw the product it is loading but carries it to the end of the car, as shown in the illustration. It reaches eighteen feet into the car, fifty per cent further than any other make of loader.

The conveyer is supported on two arms hinged from a post in such a manner as to be easily moved into a box car by hand. The chute is on the lower side of the car and follows the loader in all positions. At the receiving end of the belt loader is a deflector which turns the coal as it comes from the chute in the direction of the conveyer, thereby reducing the breakage. The conveyer is tilted by turning a crank.

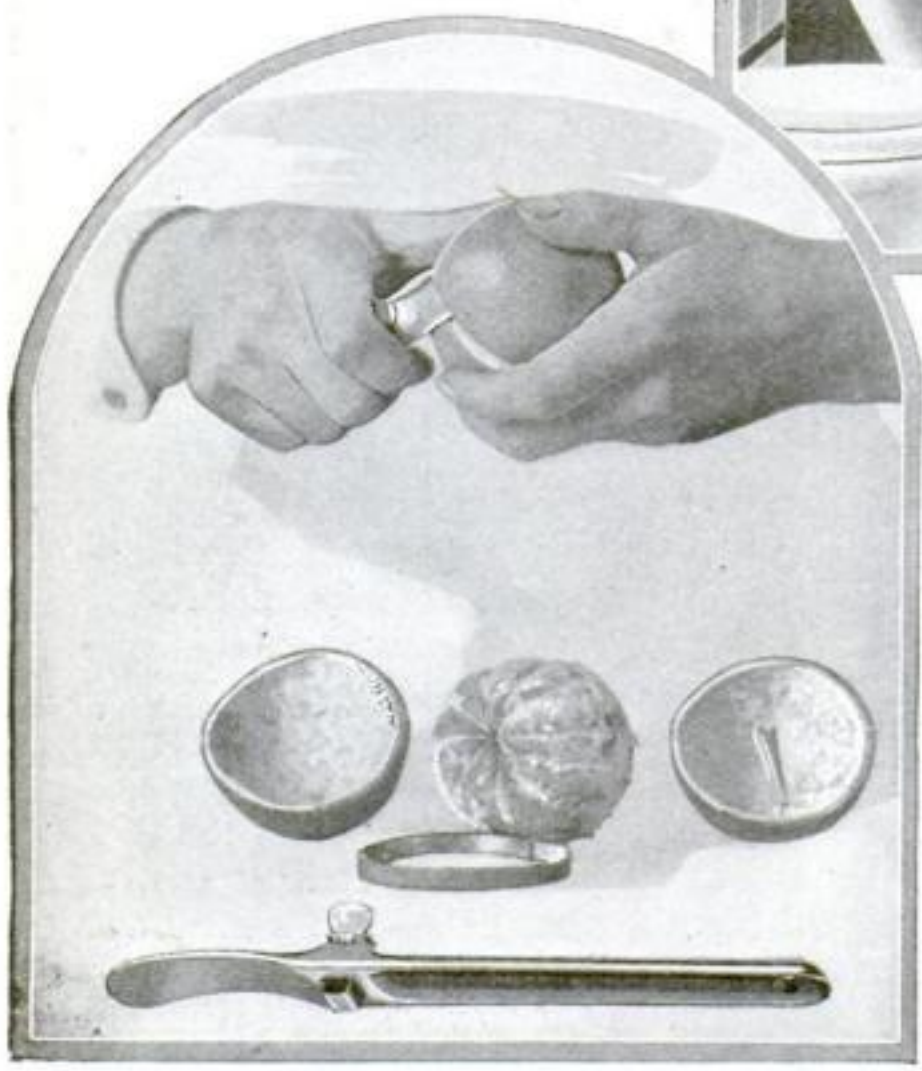
Housekeeping Made Easy

A new way to seal cans of vegetables and fruit without using solder. The filled can is placed in the "sealer" as shown above. A turn of the crank seals it

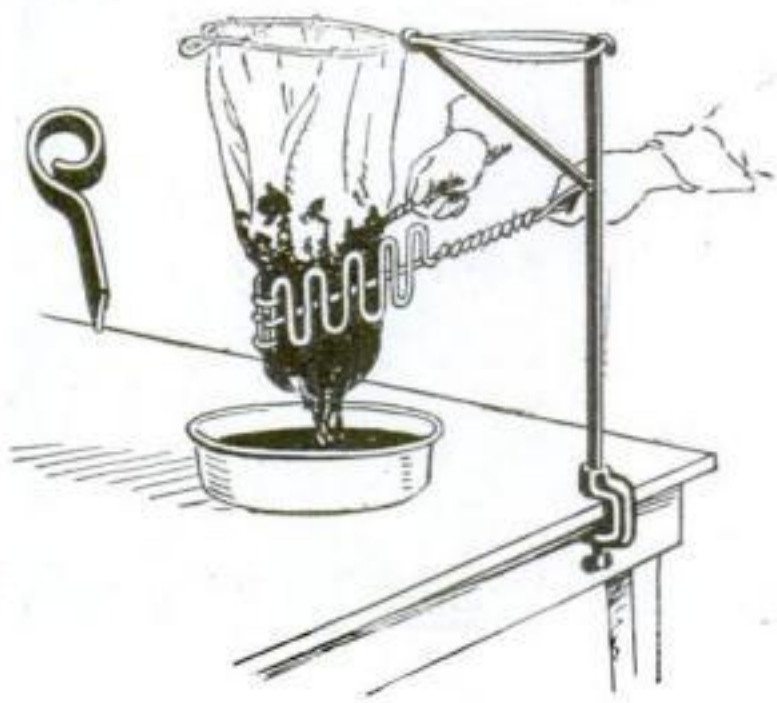
A small white enameled stand with an enclosed space for brushes and shoe-polishing utensils makes a handy bit of furniture



A foot-rest for the bath-tub. It hooks over the edge of the tub like a soap holder. An adjustable piece in the back holds it out

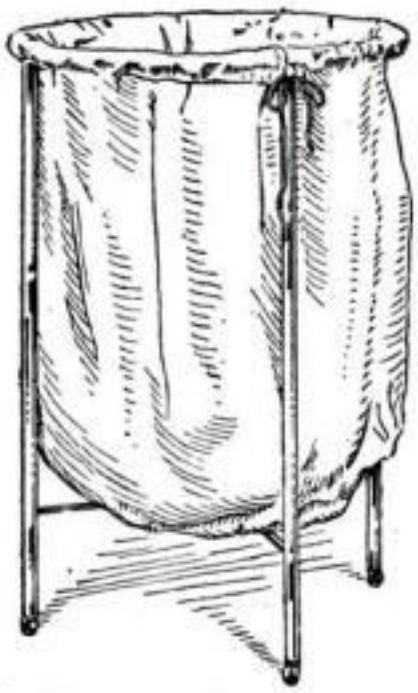


A device for removing the peel from an orange without soiling the hands or wasting the juice. It can also be used for slicing the peel in various patterns for decorative purposes



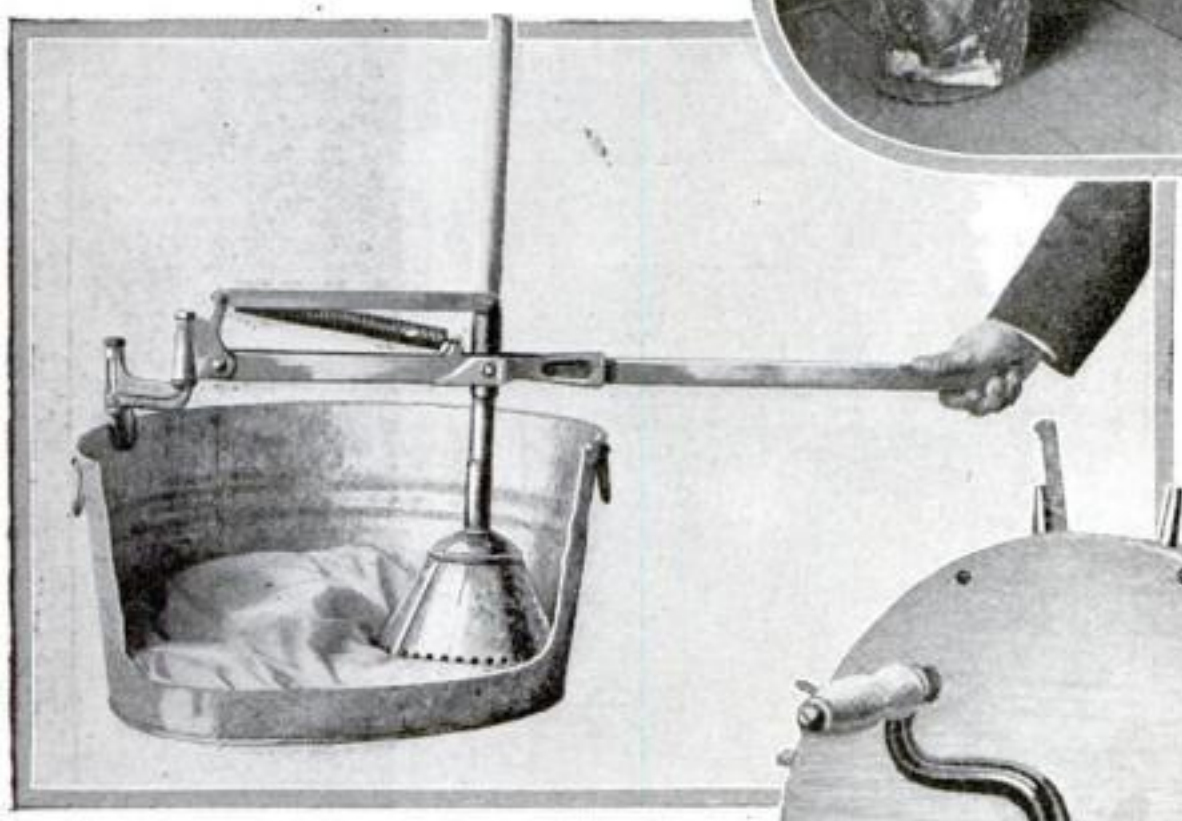
A squeezer for hastening the process of jelly-making. The last vestige of fruit juice can be extracted in this way without staining the fingers or clothes

Housekeeping Made Easy

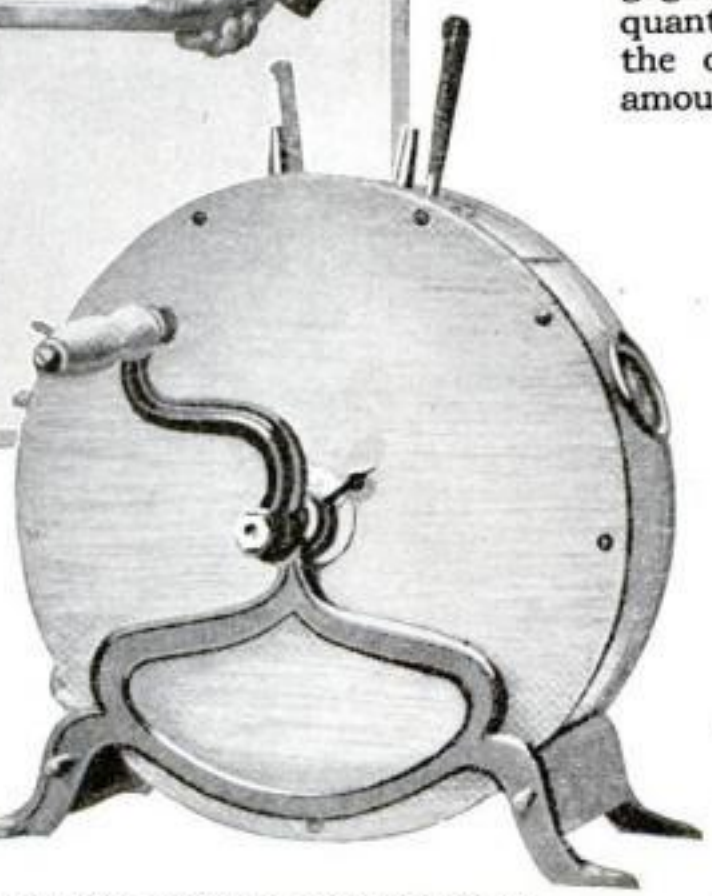


A hamper for soiled linen. The joints of the four-legged, enameled steel frame are welded

You do not have to turn this extinguisher upside down to use it. It has two gages, one to show the quantity of liquid and the other to show the amount of air pressure



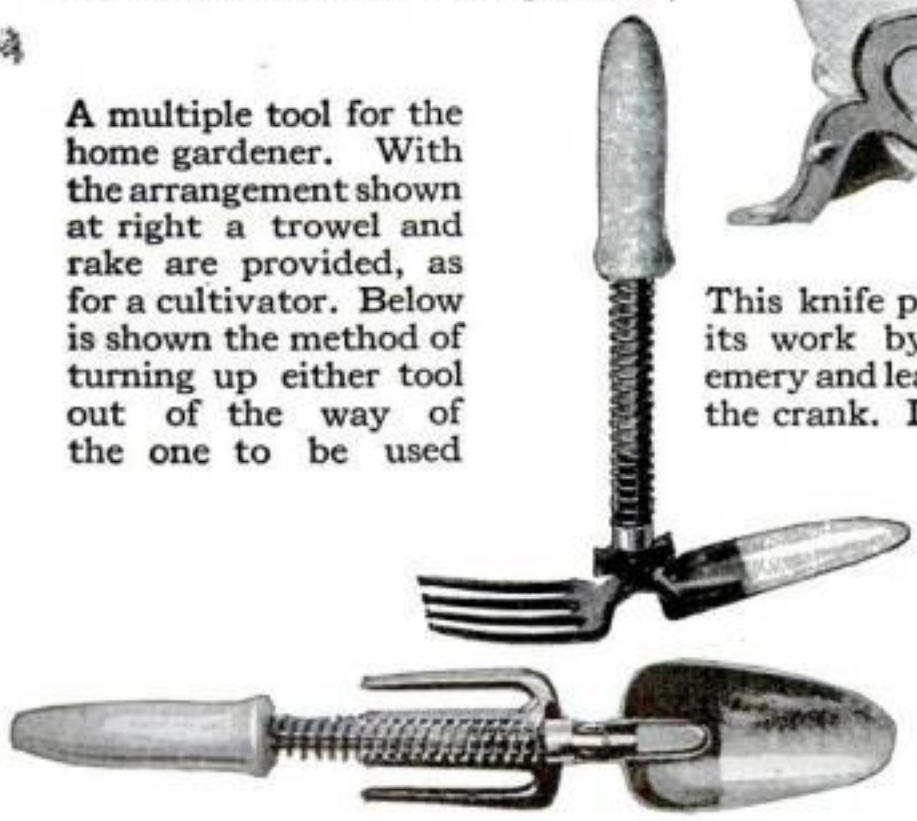
A vacuum washer to be attached to the side of the tub. The spring assists in lifting the cup and the handle controls its tub position



This knife polishing machine does its work by means of powdered emery and leather disks revolved by the crank. It is made in two sizes

A kerosene lamp may be converted into an up-to-date electric light by inserting a bulb and connecting it with the circuit

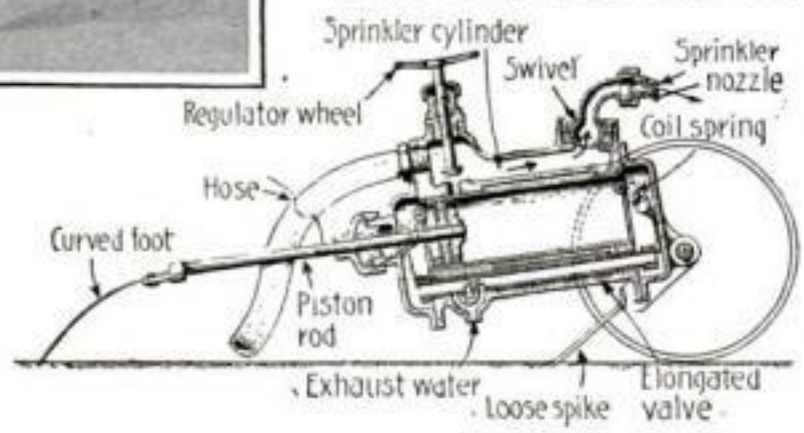
A multiple tool for the home gardener. With the arrangement shown at right a trowel and rake are provided, as for a cultivator. Below is shown the method of turning up either tool out of the way of the one to be used



Most sprinklers stay where they are put. This one hops along like a toad and waters new ground. At right is shown the details of the design

The First Life-Long Flashlight. A Generator Furnishes the Power

THE first life-long flashlights are soon to be placed on the market by French manufacturers. They will be warmly welcomed by motorists. The usual batteries, which are frequently renewed if used constantly, are replaced by a tiny electric generator. The generator is driven by a clock-work mechanism which is simply wound up when the battery is to be used. Since the ordinary flashlight bulb requires very little power, the strong clock spring will keep the bulb lighted for a considerable time. There is nothing in the battery mechanism to deteriorate. With a little care, it will last for years.

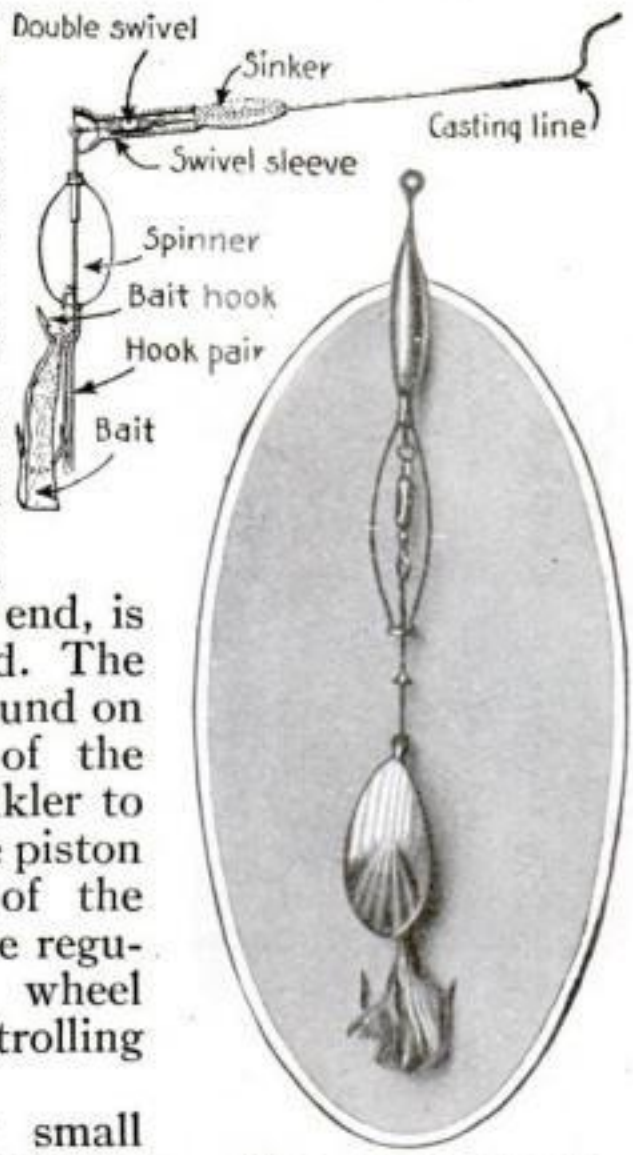


A Sprinkler Which Propels Itself Over the Lawn

A LAWN sprinkler which crawls or rather hops along the garden under its own power has been invented by George C. Bohnenkemper of Denver, Colorado.

The apparatus is simply constructed, consisting mainly of a cylinder and piston mounted on a pair of wheels. A hose leading from the water supply main is attached to the sprinkler. When the water is turned on, the piston within the cylinder reciprocates. At each forward stroke of the piston a curved metal foot, spiked at its lower end, is dragged along the ground. The spiked foot stabs the ground on the backward motion of the piston, causing the sprinkler to advance the length of the piston stroke. The rapidity of the piston movement may be regulated by means of a wheel above the cylinder controlling the supply of water.

As a comparatively small amount of water is required to operate the motor, the main supply finds its way to the sprinkler-nozzle which keeps up a continuous spray.



The spoon hook with new position of lead weight, and two wires directly beneath it to prevent tangling line

A Spoon Hook Which Will Not Tangle Your Fishing Line

FOR ten years Charles Leonard, of Lake Geneva, Wisconsin, got his fishing line tangled or fouled when he used a spoon hook and pork bait for the large mouthed bass that abound in that section of the country. Sometimes the hook would snarl his line four or five times in succession, taking all the pleasure out of the pastime. Making up his mind one day that he would invent a spoon hook of his own that would not tangle his line, he proceeded to the task, and the result is that his name is in the Patent Office and he has a spoon hook which can be cast all day without snarling the line.

In the old type of spoon hook the casting weight was attached to the line just above the spoon. This was the cause of all the trouble. In this new hook the weight is attached at the top of the hook, above the joint. Attached to the under side of the lead weight and leading down to a ring below the joint are two wires which prevent the spoon end of the hook from buckling or doubling back. The inventor says he has cast the hook for three hours without a tangle.

A Camera to Be Handled Like a Pistol

It is a happy combination of a leveling and sighting appendage and a repeating mechanism

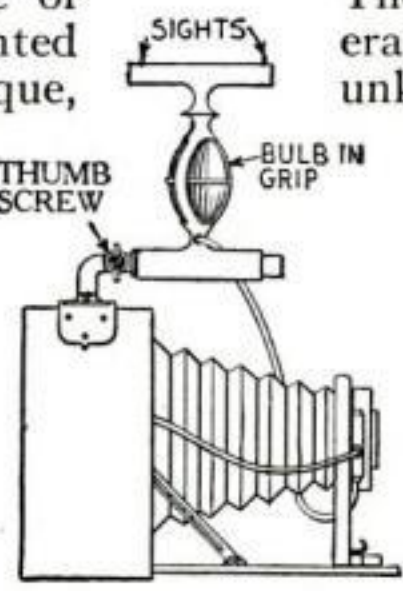
TO handle a camera as easily as a ranchman manipulates a six-shooter, and to make its aim and result equally effective, is the purpose of several ingenious inventions patented by J. N. Johnson of Albuquerque, New Mexico. He has obviated the necessity of clumsily focusing the camera by means of a finder. In addition, he claims that the camera may be aimed and operated with one hand, like a revolver, and all its films discharged, without the loss of clearness and accuracy.

The camera is the happy combination of two devices: a leveling and sighting appendage, and a repeating or magazine mechanism. These devices may be used separately, if desired.

The leveling and sighting appendage is a simple contrivance constructed of two horizontal tubes connected at their center by a vertical tube containing the shutter-operating bulb. This bracket-like device may be placed on the top or the bottom of the camera, thereby enabling the photographer to aim in any direction he wishes—horizontally, vertically, or over the heads of a crowd. The bracket is so pivoted that the camera hangs automatically plumb or level, no matter how the operator holds it. The shutter is operated in the familiar way by compressed air sent through the rubber tube by the bulb in the handle. The sights on the upper bar of the bracket take the place of the finder and insure the accuracy of the photographer.

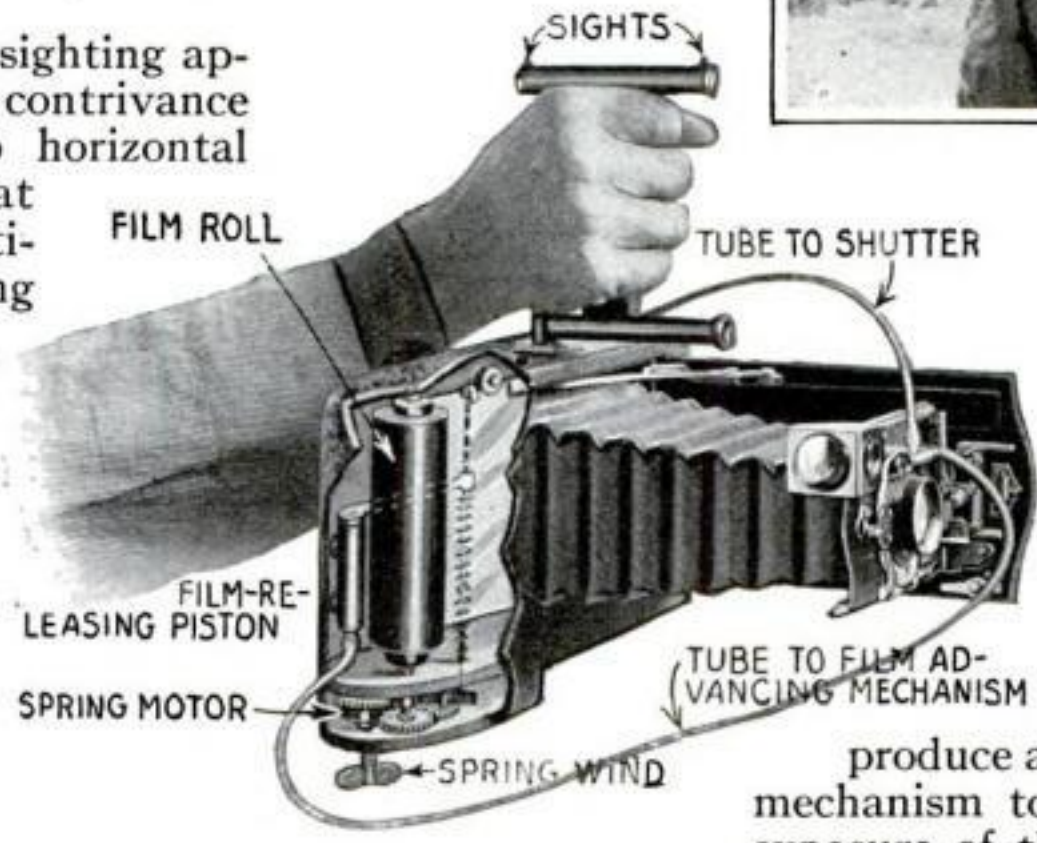
A motor-operated mechanism is the second important device, designed automatically to shift the film after each movement of the shutter, so that a number of snap shots may be taken in rapid succession. This invention is conveniently adapted to the ordinary film now in use. Though other magazine cameras operating on this general principle are not unknown, the present invention is to improve the shifting of the film so that it may be turned by a mechanical contrivance actuated by air pressure. It also aims to produce a direct and running mechanism to prevent a double exposure of the film. A spring-like contrivance moves the film over the rollers, a movable pin controls the starting and stopping of the film at the right point; air pressure opens the shutter; while its exhaust releases this spring contrivance which sets the film rolling for the next picture.

The self-leveling repeating camera is the combined result of these two inventions. The accompanying pictures illustrate its makeup and its operation. They show its large range of possibilities as a snap shot camera. The camera fiend can stalk his prey with even less difficulty than in the past.



The principal details of the self-leveling repeating camera

"Any child can do it." This small boy, who never had a camera in his hand before, made a series of very fine pictures at the first attempt. The camera is balanced on a pivot



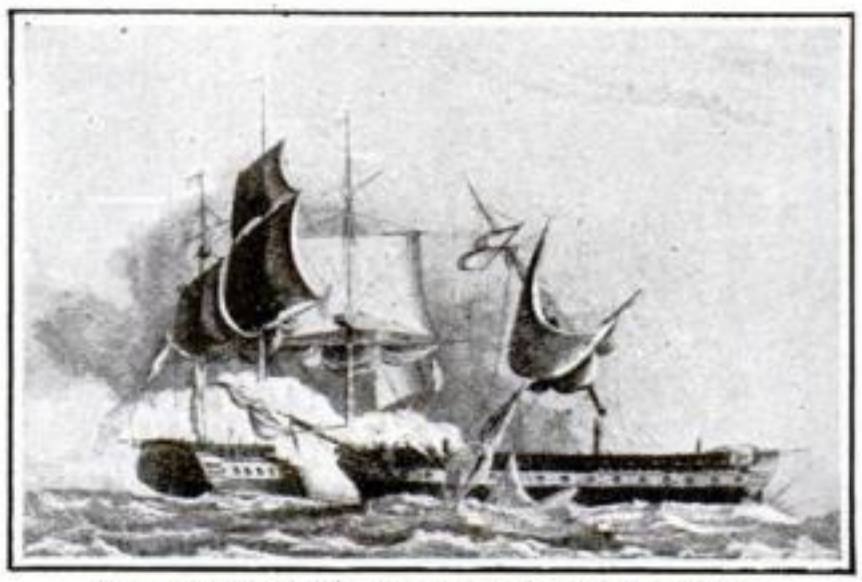
The Unbeaten "Constitution"

Step on board with us and see the guns that won thirty-nine glorious victories

By Thomas Stanley Curtis

THE frigate *Constitution*, fighter of thirty-nine battles and winner of every one of them, to-day offers the student an exceptional opportunity to compare the naval fighting machine of a hundred years ago with the super-dreadnought of the hour. Peacefully floating at a wharf in the Charlestown, Mass., Navy Yard, "Old Ironsides" speaks volumes to the thoughtful visitor who has perhaps just a few minutes before stepped down the gangway of a modern ship.

In the war of 1812, after a long series of brilliant exploits, the *Constitution*, under command of Commodore Hull, summarily defeated the British ship *Guerièrre* in an engagement which lasted but a scant hour and a half.



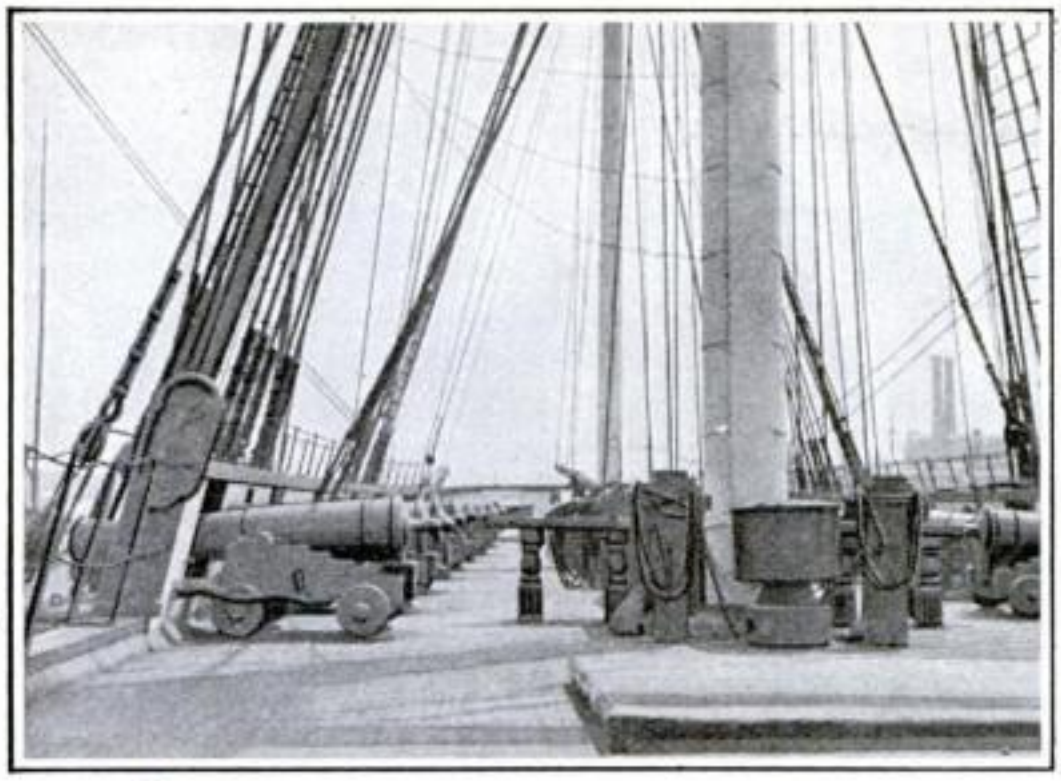
***Constitution* fighting the *Guerièrre*.** **The most famous battle of Old Ironsides. Reproduced from an old print**

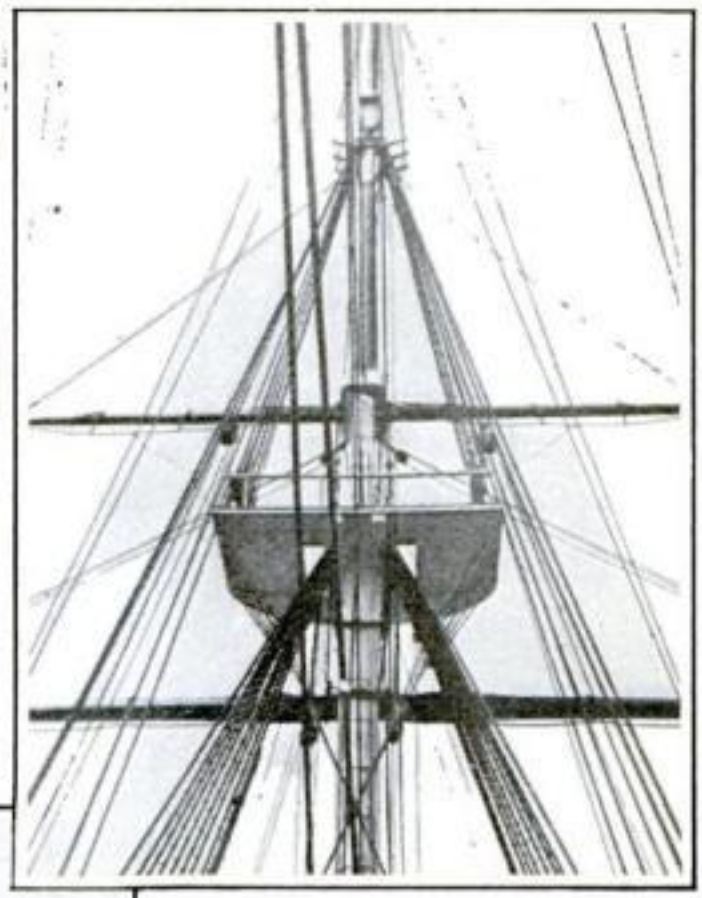
On the nineteenth day of August, the commander of the *Constitution* received word from the captain of an American brig that a British frigate had been sighted cruising in the vicinity. Acting on the information, Hull immediately gave chase in the direction indicated and at 2 o'clock P. M. the *Guerièrre* was sighted. After a three-hour run, the *Constitution* came within range of the enemy's guns and the *Guerièrre* let go a broadside, which, however, did no damage. Turning, the British ship fired her port broadside and scored two hits. For three-quarters of an hour the enemy discharged alternate broadsides with little effect while the American ship replied only with her bow guns.

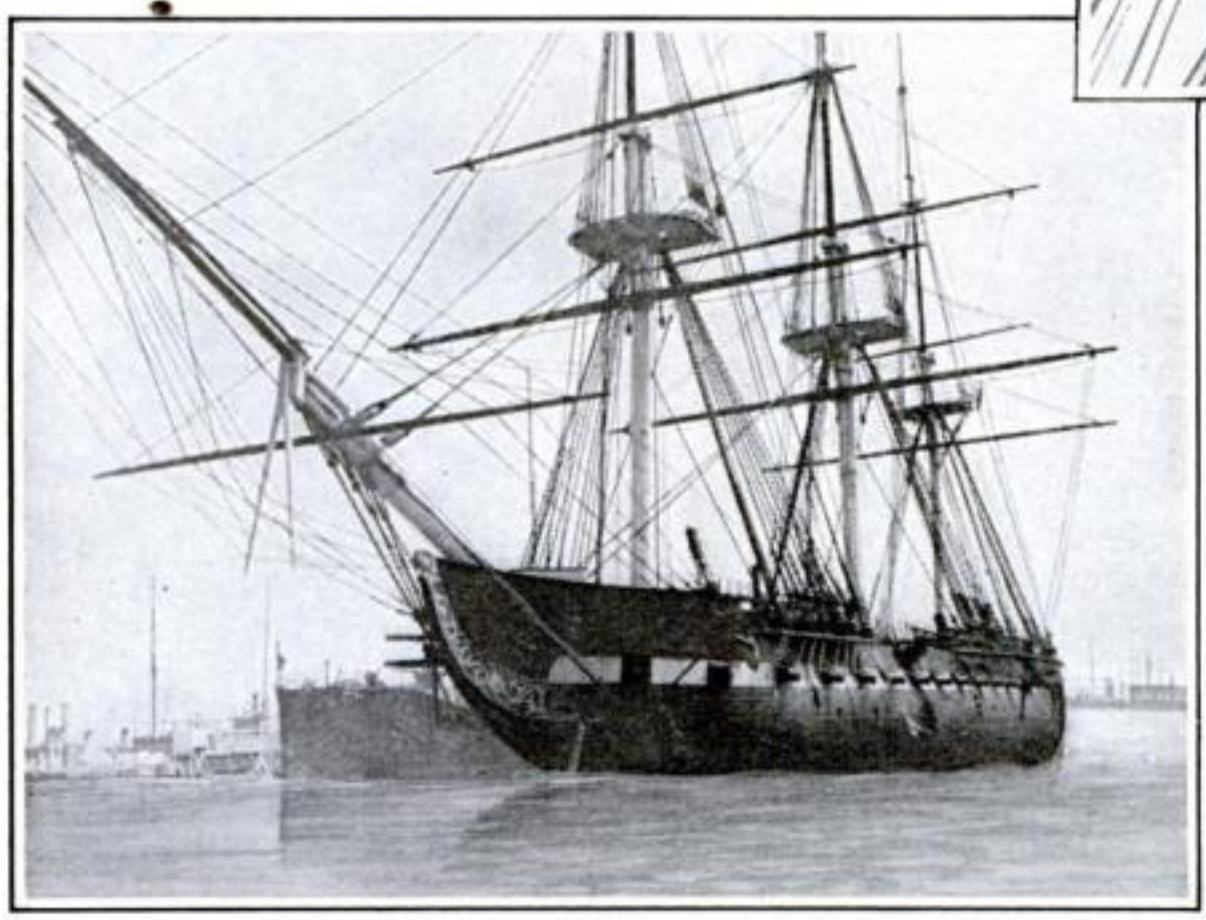
At 6:05 P. M. the *Constitution* had closed in on the *Guerièrre* and for the next few minutes both ships fired one broadside after another at a range of some two hundred yards. After ten minutes, Hull opened at close range with his whole broadside and the *Guerièrre's* mizzen mast went over on the leeward side. At this stage the American commander determined to cross the bow of the enemy and rake his deck with a broadside. Disabled in her rigging, however, the ship failed to answer the helm quickly. After two terrific broadsides had swept the deck and pierced the hull of the British ship, practically deadlocked to the enemy and already weakened by the raking fire, the *Guerièrre* was worked up into the wind against her helm by the fallen mizzen mast and thus brought directly under the guns of the *Constitution*. As the American ship pulled away, the two remaining masts of the *Guerièrre* were shot away and the British ship was a total wreck with her guns of the main deck under water. The engagement ended at 6:30 with the surrender of Captain Dacres of the *Guerièrre*.

From this brief account of a typical naval battle of the time, the reader will note that the conflict was little short of hand-to-hand; towards the close of the engagement the contestants were actually locked together with the bowsprit of the one fouled in the rigging of the other. To-day the contestants scarcely see each other's ships. Whereas the fighters of a hundred years ago could actually see the whites of each other's eyes, now there is not a living thing visible on the deck of a ship in action. The gunners of the *Constitution* could "draw bead" on the hull or deck of the *Guerièrre*, and when they wished to elevate a gun they would tilt the muzzle by withdrawing a wooden wedge beneath the breach. To-day the gunner seldom sees his target; his range is given him in figures through a telephone and he fires at signal: the

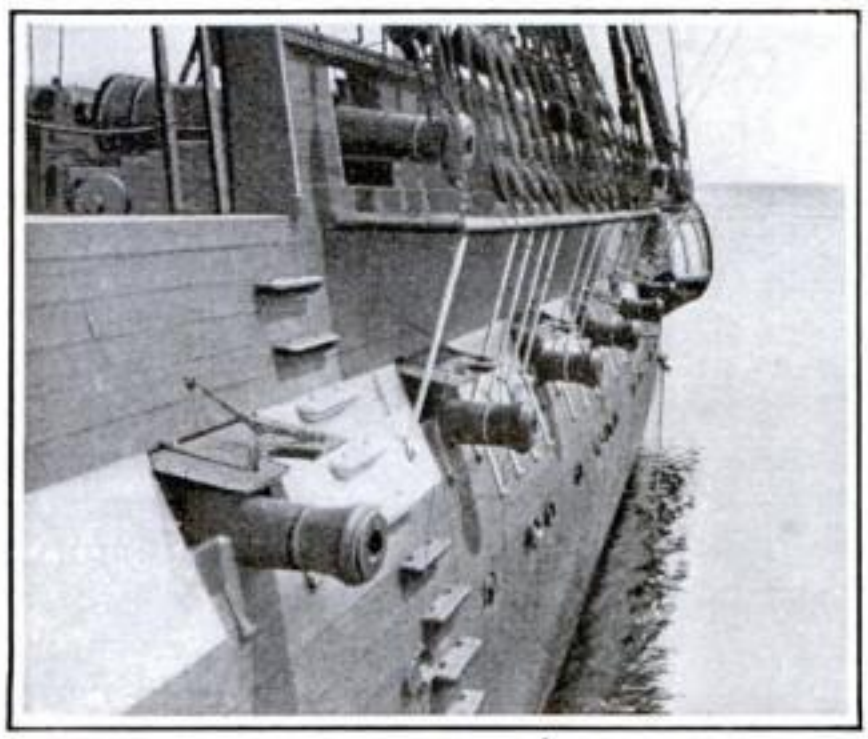
Battle-Scarred "Old Ironsides"

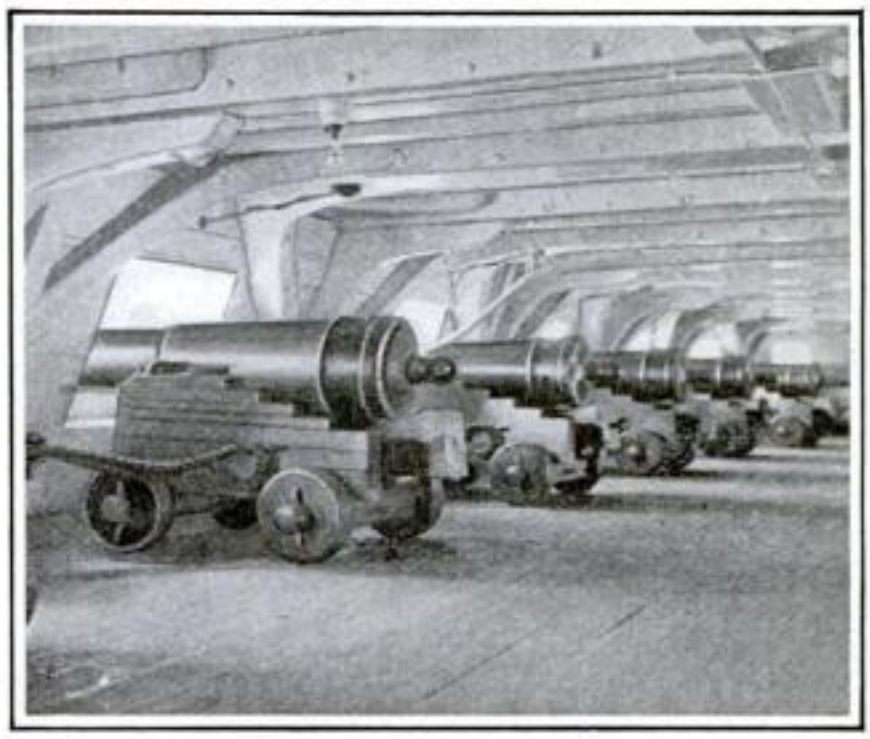






Peacefully floating at her dock the famous old frigate Constitution, once a dreadnought of the seas, presents a striking contrast to the grim battleships of the present which rest near her. One of the most remarkable variations between the new and the old fighting ships is the fact that the shell fired by one of our superdreadnoughts weighs practically as much as the biggest gun carried on the frigate Constitution





The teeth of Old Ironsides which helped win thirty-nine battles. The ship has been re-rigged and refitted just as she was in her fiery days of a century ago. She is spending her old age at the Charlestown Navy Yard, in Boston. Her reputation was made in the war of 1812

muzzle of his gun is elevated, depressed or turned laterally by an electric motor through gearing.

The spar deck of the *Constitution* carries twenty-two thirty-two-pound carronades, the muzzles of which project through square ports. The cannons are mounted upon massive wooden carriages running on chunky iron wheels. The recoil carried the cannon back to a point determined by the length of a heavy hawser or rope. For reloading, the pins were removed from the loops in the ends of the rope and the gun carriage rolled back nearly to the center line of the deck. The policy of discharging alternate broadsides was to enable the gun crews to reload while the ship was turning.

Contrasts in Actual Construction

Aside from the vastly different methods of placing the guns, perhaps the most striking contrast between the naval architecture of a century ago and that of to-day is seen in the actual structure of the hull and superstructures. The warship of today has not a piece of wood visible, with the possible exception of the deck, which is wood over a steel foundation. Stripped for action, the modern fighting craft presents a positively naked appearance with every movable object cast overboard or stowed away. The *Constitution*, on the other hand, presents a bewildering array of rigging and spars, and she is wholly constructed of wood. A single modern shell exploding under or on her deck would do as much damage, probably, as an entire broadside from a ship similar to the *Guerièrre*. This vast change in the design is, of course, due in large measure to the introduction of steam as a means of propulsion. Following this the all-steel hull was introduced.

The gun deck of the *Constitution* stirs the imagination perhaps still more than does the spar deck. Topped by a low ceiling which makes one want to stoop as he walks, this deck savors of a prison dungeon. Glancing at the row of long twenty-four-pounders, thirty in number, one can readily picture the smoke-filled atmosphere, the terrible din, the sweating, half-naked figures straining to reload the clumsy pieces of ordnance, and ever and anon a shot crashing through the futile wooden wall sending splinters in all directions. Stepping from the gun deck and the turrets of the *Rhode Island* to this old-time chamber of horrors, the visitor cannot fail to wonder how in her famous engagement the *Constitution* suffered a loss of but seven killed and seven wounded out of a crew of four hundred and fifty-six officers and men. Perhaps the answer is found in the inaccuracy of the guns and poor marksmanship of the gunners; more likely, however, it is due to the fact that the explosive shell had not then been invented. Aside from the splinters, a twenty-four-pound shot through the hull stood little chance of doing really great damage unless it struck a mast, a gunner or the gun carriage itself.

The guns of the *Constitution's* day had an effective range of possibly a mile, although history tells us that the real execution was done at ranges of from one to three hundred yards. Think of the engagements of the present European war, wherein naval duels are fought at ten miles' range and where the opposing ship is actually out of sight from the gun deck and barely visible from the fighting tops! Think of guns aimed with the aid of mathematics! What marvelous strides science has made in times of peace and in the short space of a hundred years!

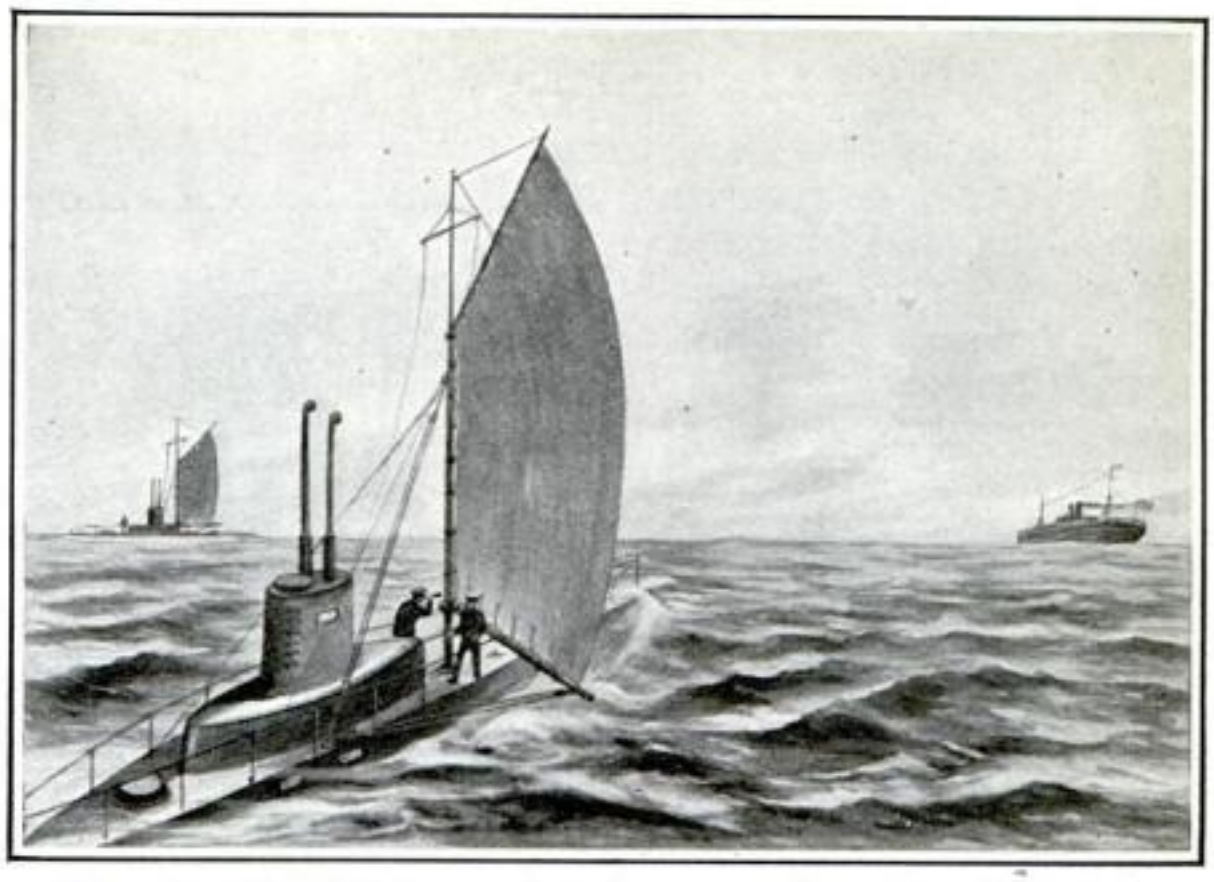
As an interesting comparison of the guns of to-day with those of 1812, we may call attention to the fact that while the total broadside discharge of the *Constitution's* battery would amount to six hundred and eighty-four pounds of metal, a single projectile from one of our coast defense mortars weighs half a ton.

Comparison of Projectile Force

Even more striking is the fact that the projectile from a modern fourteen-inch piece of ordnance such as that carried by the super-dreadnoughts, weighs practically as much as one of the big guns of the *Constitution*; in other words, instead of hurling a small ball of iron at its enemy the modern fighter of the seas could actually throw one of the *Constitution's* cannons itself at the opponent were the cannon of suitable shape and form. And, furthermore, the explosive charge in the projectile would be greater by far in power than the entire charge used to fire the old cannon. This means that the modern engine of destruction actually takes a mass of steel equal in weight to the old gun, loaded with high explosive, and lands this entire mass on the deck or inside the hull of the enemy's ship, where it explodes.

The Largest American Flag in Existence

THE city of St. Louis, Missouri, possesses the largest American flag in existence, as far as is known. It is 150 feet long and 78 feet wide. Each of the thirteen stripes is six feet wide. Imagine a plot of ground containing 11,700 square feet—almost one-quarter of an acre—and you will have an idea of the size of the flag. When used in parades it requires two hundred people to carry it. But on account of its great width it cannot be carried through many of the streets of the city.



The submarine hoists a sail and runs on the surface in order to approach within striking distance of a fast freighter

This Machine Is Five Times as Fast as an Expert Bank Teller

AN expert bank teller can count by hand from six to ten thousand coins per hour for one hour only. With the new machine illustrated one man, not an expert, can count fifty thousand coins per hour indefinitely.

Mistakes are impossible. In the course of a certain test, two thin dimes were glued together and mixed with the mass of coins. The machine separated the coins and the final registration showed the correct count. Mutilated coins or thick counterfeits stop the machine.

There is a separate head or counter for each denomination of coin, and the change from one size to another can be made instantly. The coins pass between two wheels, one at a time. The cyclometer, which is in plain view, shows the exact number of coins which have passed through the machine at any time. The machine can be adjusted to stop automatically. There are no springs in it.

This machine automatically counts and wraps up coins of any denomination at the rate of from 500 to 1000 coins per minute

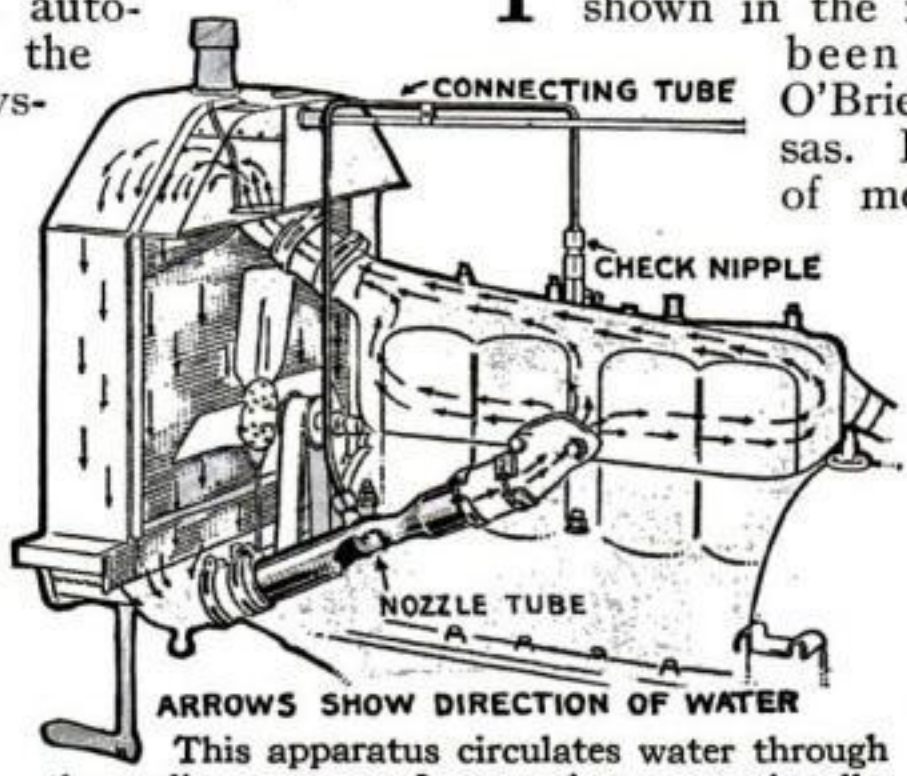
Submarines Disguised as Sailing Vessels, Creep Up to Their Prey

TO deceive vigilant merchant ships, the commanders of German submarines disguise their vessels when they can. Frequently they hoist sails so that their craft look like peaceful sailing vessels.

According to the captain of a swift British freighter, as he was standing on the bridge of his vessel one day he sighted a craft lying low in the water, far astern. He had looked in that direction a few minutes before and there was no ship in sight. That aroused his suspicion. Furthermore, the ship was moving along much faster than the wind alone could have taken her. Ordering full speed ahead, he kept his eyes on the strange vessel, finally becoming convinced that it was a German submarine disguised as a sailing vessel. There was not much of a breeze but the ship cut through the water at high speed just the same. After the mysterious craft had followed his vessel for several hours it disappeared entirely, sails and all.

Automobile Engine Cooler Operates on Steam Ejector Plan

THE latest accessory to aid the water circulation of an automobile engine forces the water through the system at a speed proportional to the engine heat generated. The device is built on the principle of the steam ejector used to draw water from a tank into a steam boiler. The harder the engine labors, the more water is circulated, so that the possibility of overheating through an insufficient supply is greatly lessened.



This apparatus circulates water through the cooling system of an engine proportionally to the heat that is generated by the engine

The device does not take the place of the radiator but simply aids it in its work. It is to be fitted on engines using the thermo-syphon cooling system in which the water automatically circulates because hot water rises to the top and colder water drops to the bottom. The water is cooled in passing through the radiator by the contact of the in-rushing air against the radiator core and passes from the bottom through the engine water jacket and out at the top, as shown in the accompanying illustration.

The device has no moving parts. It consists of two pieces, a length of pipe between the bottom of the radiator and the water jacket intake and a smaller pipe screwed into the exhaust manifold. This pipe, bent over the top of the engine as shown, terminates in a small nozzle pointed toward the engine inside of the larger pipe. Exhaust gas through the smaller pipe escapes through the nozzle into the water which it forces forward at a speed which is directly proportional to the pressure of the gas.

A ball-check valve in the small pipe prevents any of the water from backing up into the exhaust manifold, as its tendency usually is when the engine is stopped.

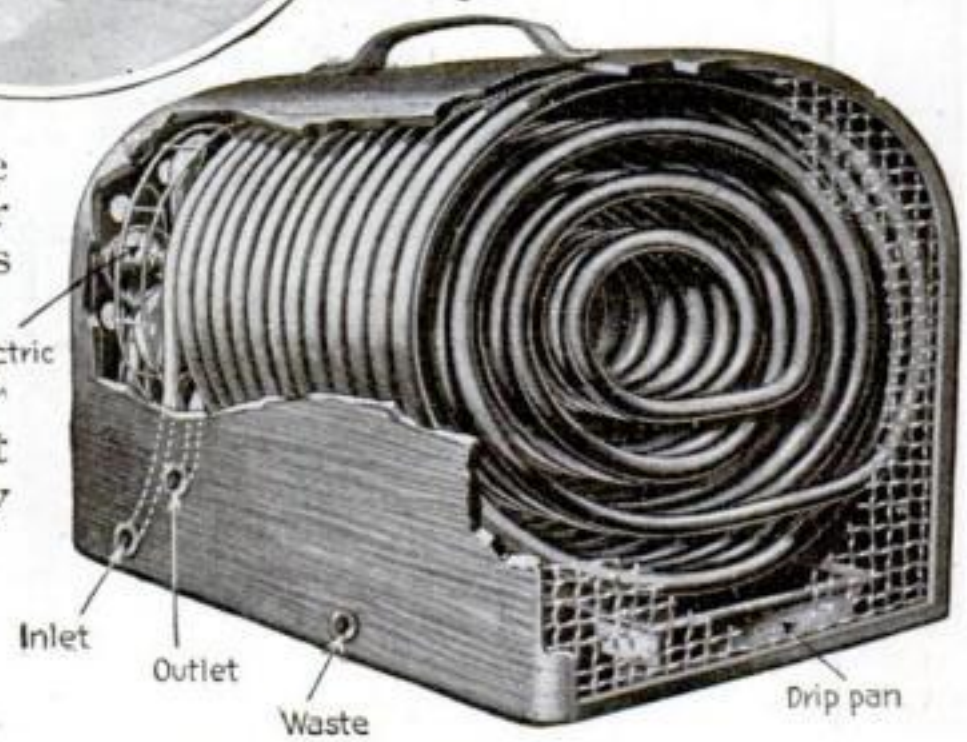
Cooling the Air of a Room with Cold Water Pipes

THE simple but effective air cooler shown in the illustration below has been patented by Glen O'Brien, of Manhattan, Kansas. It consists of four coils of metal pipe, fitted one inside the other for compactness. Cold water flows through the pipes while an electric fan blows the sultry air of the room over them. The air leaves the pipes cooled down to nearly the temperature of the water, and spreads out over the room.

This apparatus is both economical and simple to operate. Few things are cheaper than city water.

Humid and damp air is also deprived of its disagreeableness by this apparatus. The mere act of lowering the air's temperature "squeezes" out most of its moisture, which condenses on the cold pipes. Any dust and germs in the air will be carried down with the water in the process. The air is thus purified.

By merely pressing a push-button held in the hand the air of the room can be changed by the patient

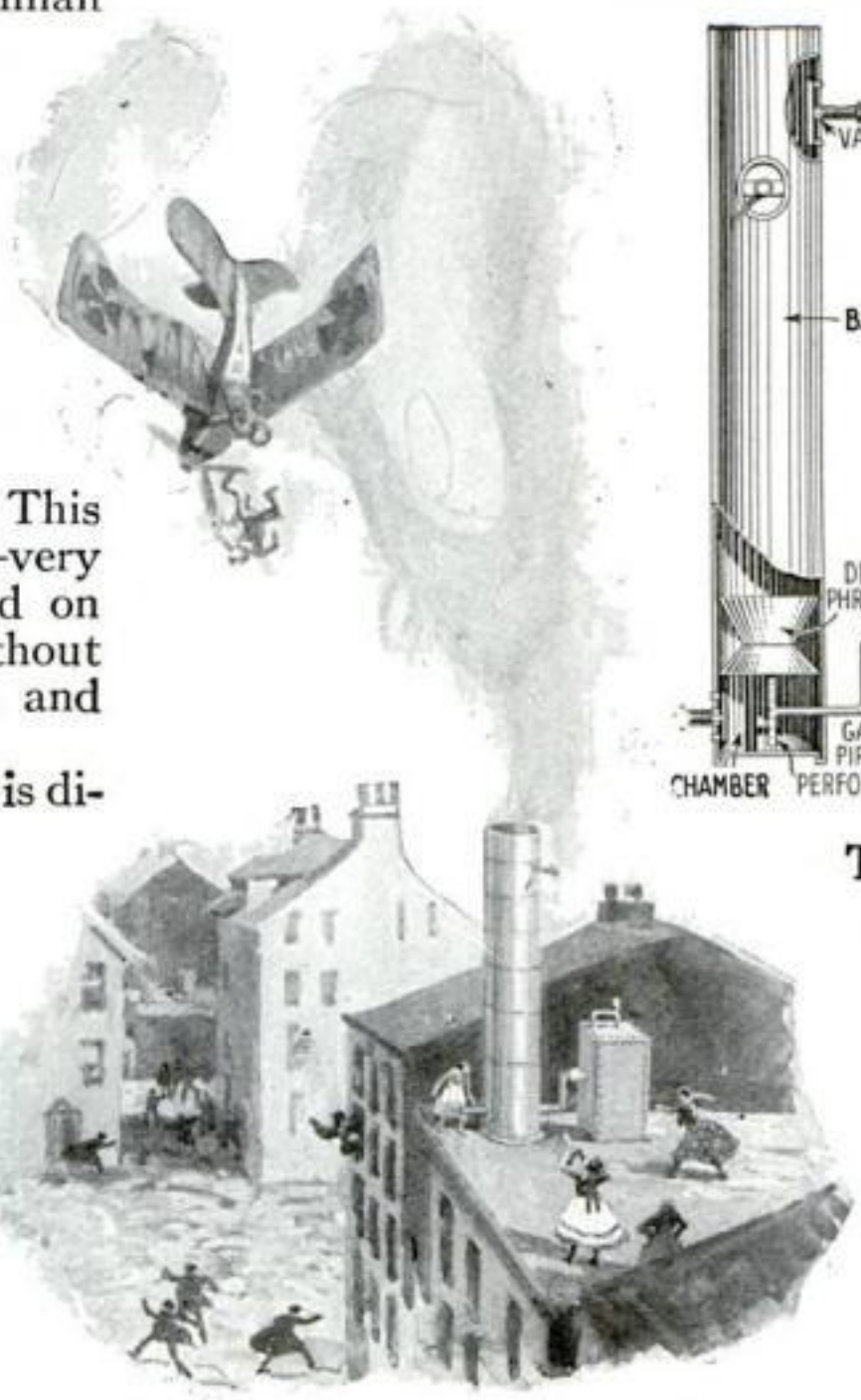


A fan blows the air over a hundred coils of water pipes, cooling and purifying it

Alas! It Will Not Work—This Method of Foiling Bomb-Droppers

AND now come Mary Hannah Clarke, born Ashton, banker and British citizen but residing at Paris, France, and Mr. Demetrio Maggiora, engineer and Italian subject but residing in the same city, with a new invention. These two secured sole American rights to an anti-airplane ordnance of the most flabbergasting construction. This ordnance is light of weight—very light, and might be erected on the roof of a house without interfering with insurance and building regulations.

When the hostile aircraft is directly over the house, this remarkable sheet-iron gun is fired and sends aloft gigantic whirling rings of combustion gases which twist the aircraft around, as a cyclone the oak tree in its path, and forthwith sends it spinning in desperate curves precipitately to the hard pavement below. Whereafter Maggiora and Mrs. Clarke go down the stairs and view the remains with lively and mutual satisfaction at their joint ingenuity.



The tornado-spurting gun and its gas generator in operation on a housetop. At right above is a diagram of the contrivance

Witness the accompanying drawing. The little thing to the right is the generator of the powerful gas. The gas is admitted by a valve to the explosion chamber below in the smoke-stack-gun where it is mixed with air. The choke port above this chamber looks scientific and perhaps has other merits. The charge is ignited by electric spark, of course.

And now notice the precautions taken for successful operation. The long tube which is supposed to endure the explosion from within might collapse from the pressure of the atmosphere when a vacuum is suddenly created inside of it by the eruptive discharge of its contents. Hence a series of large valves are arranged spirally. They open automatically and admit the air to the vacuum gradually and softly.

The Policeman's "Billy" Becomes a Whistle

THE inventors have discovered that the ordinary hardwood club of the policeman is not so efficient as it looks.

James A. Byrne, of West Orange, N. J., has been struck by the fact that when an officer clutches a prisoner with one hand and his club with the other, he is not in a position to take his whistle from his pocket. Mount a whistle on the end of his club and the problem is solved. The whistle is inserted in the handle of the club; an opening near the top permits the escape of air when the whistle is blown. Both the neck and the mouthpiece of the whistle project beyond the handle end of the club, but they are concealed from view by a cap held in position by a spring catch. If the policeman wishes to blow the whistle in an emergency, he presses a push button and the cap flies back, exposing the whistle to view.

The ordinary policeman's club with a whistle in the handle. The whistle is concealed by a cap which flies back automatically

Applying the Idea of the Needle Bath in Shell-Making

THE steel utilized in the manufacture of explosive shells must be carefully tempered. If the steel is too brittle or too ductile the destructiveness of the projectile is affected. Steel of the correct temper, however, does not lend itself readily to heavy machine operations. For this reason, steel shells, after the insides have been removed from the blanks and most of the surplus material cut from the outside, are subjected to what is called "heat treatment."

The first step in heat treatment is to bring the shells to a comparatively high temperature. Then they are quenched, usually in oil, and once more heated to bring the material to the proper condition.

Although projectiles of all artillery ammunition must be heat treated, the cleverness of the French and the ingenuity of the Yankee has given manufacturers a substitute for the oil bath which is an interesting and unusual adaptation of the familiar bath spray.

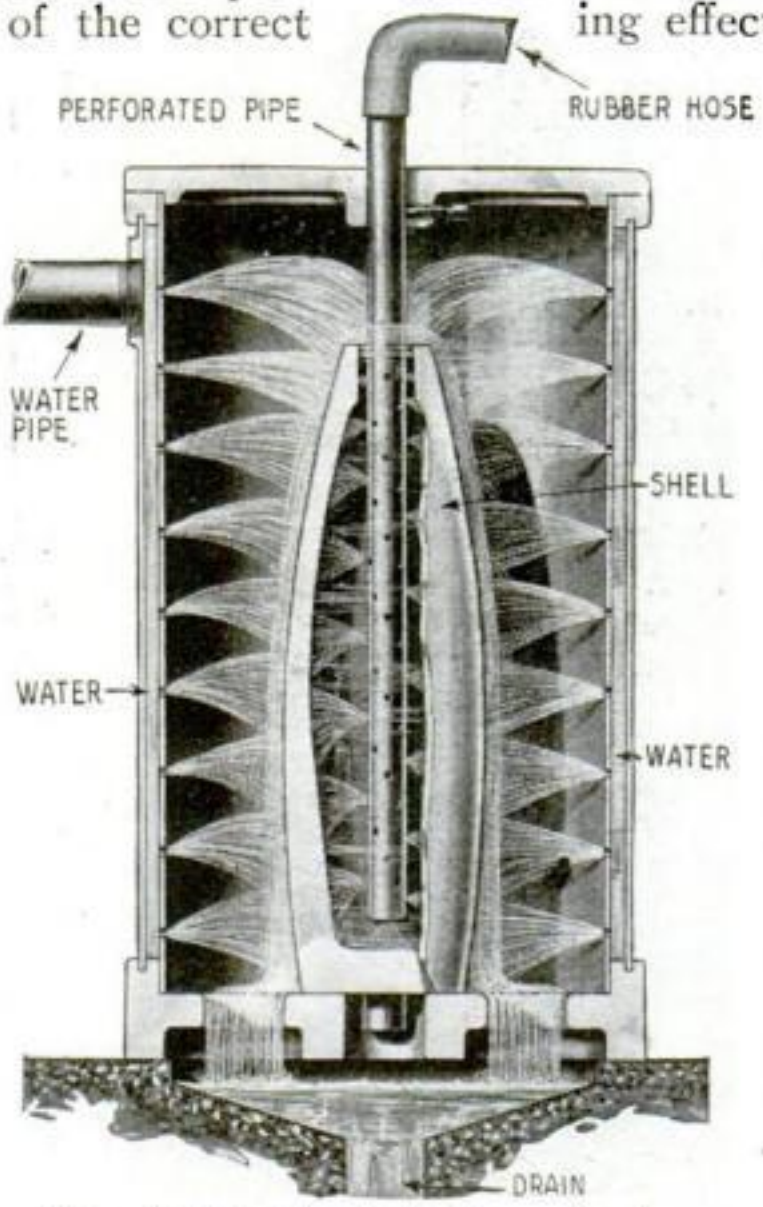
The accompanying illustration could with very little imagination be taken as a model of the original needle bath.

The shell bath is a cylindrical, double-walled receptacle, not unlike one ashcan placed within another. The space between the concentric walls forms a reservoir for a supply of water under pressure. The inner wall is perforated, and there is also a central perforated pipe passing through the top of the needle-bath, where it connects with a piece of ordinary rubber hose.

The shell to be cooled is placed in the main chamber, the perforated pipe inserted in the nose of the shell and the water sprayed on the inside and outside of the heated case.

The shell is taken for this bath from a heating furnace where it has been kept at a temperature of 1800 degrees Fahrenheit for some thirty minutes, and it remains in the bath until cooled thoroughly.

Plunging the hot shell immediately into a tank of cold water after taking it from the furnace would be treatment too heroic and would without doubt do a great deal more harm than good; but the gentle cooling effect of the shower bath has proved highly efficacious. A spray of cold water seems to be as beneficial to the temper of a shell as it is conceded to be to the temper of many a fractious youngster.—REGINALD TRAUTSCHOLD, M. E.



The shell is placed in the main chamber, the perforated pipe is inserted in the nose of the shell and the water is sprayed from inside and outside

A Fortune from Old Razor Blades

A CALIFORNIA man is making a little fortune out of old safety-razor blades. It seems almost unbelievable but it is not more strange than the stories we hear of fortunes made by rag-pickers and dealers in old tin cans. This man patented a suitable blade-holder, which he sells with supplies of old blades to tailors, milliners, show-card writers, and photographers.

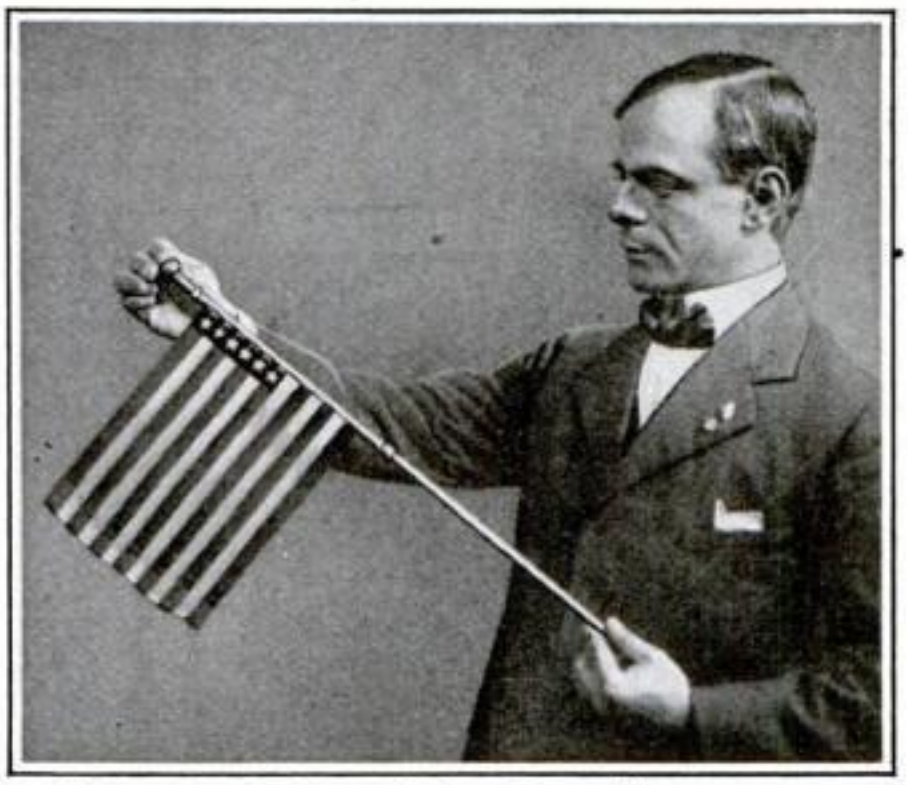
The holder is made from one piece of steel bent in half with its two sides pressing close together. One corner of the blade sticks out from the holder. It will cut one hundred ordinary sheets of paper or a dozen pieces of cloth at a single stroke.

By means of a safety holder, the blades can be used for cutting cloth, paper or cardboard

When the Star-Spangled Banner Is Played Wave Your Cane Flag

THE question of what to do with your cane when the orchestra strikes up the Star-Spangled Banner has been solved by Charles T. Fernandez, of Roxbury, Massachusetts. If you have one of his new canes you raise it above your head, turn a knob until an American flag concealed in the interior comes out through the slot, and then wave the flag as long as the music lasts.

In a word, his device is nothing more than a flag wound round a roller inside the cane. The knob or head of the cane is connected with the roller so that the flag may be wound or unwound at will, appearing and disappearing through a slot. When the flag is inserted the flag-stick fits into the cane, and the flag into the slot.



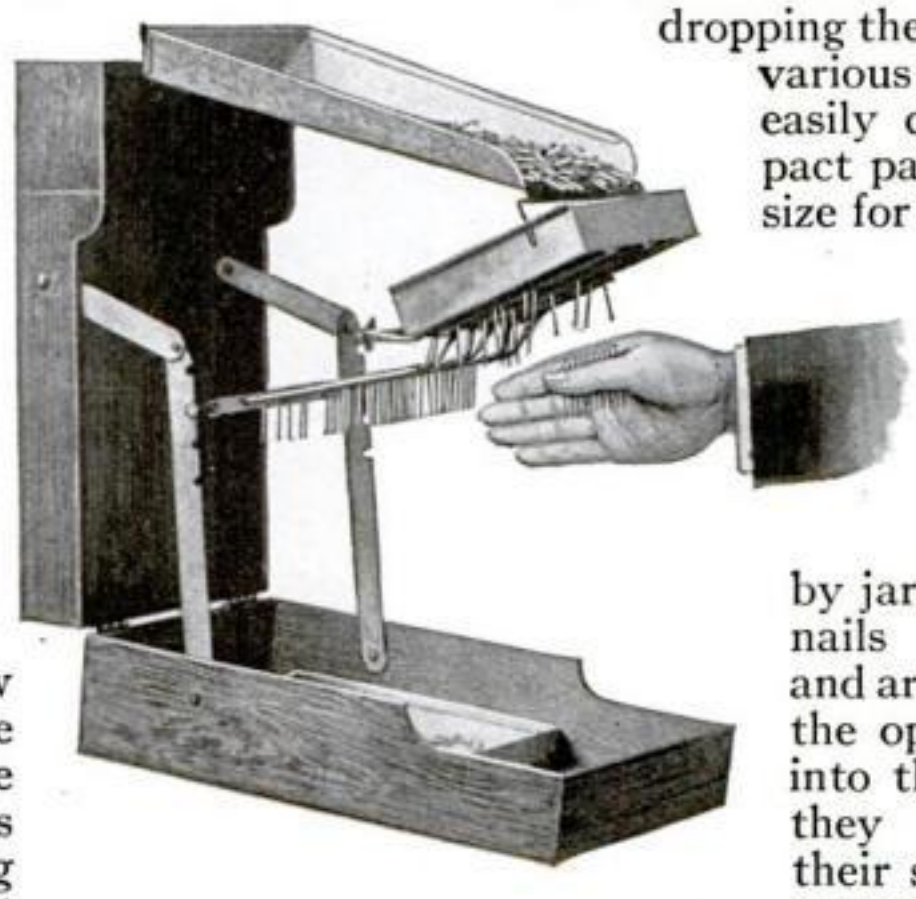
Turn the knob and the flag will come out through a slot from the interior of the cane

Fifty-Five Packages of Chewing Gum for Everybody!

AT the Kansas City meeting of the American Chemical Society, Dr. Frederic Dannerth, of the Research Department of the Rubber Trade Laboratory, presented in detail the methods for determining the content and value of block chicle, of which chewing gum is made. These are of interest only to chemists, but the statistics that Dr. Dannerth gave are enough to drive us silent from sheer jaw weariness at the mere thought of them! One pound of chicle makes four pounds of chewing gum and one pound of gum produces over fifteen and one-half packages. In 1916 we exported 718,000 pounds—say 11,129,000 packages. We shall soon see that this is a mere bagatelle. The total amount of chicle imported, manufactured and consumed in the United States in 1916 was 7,031,000 pounds, equivalent to 28,124,000 pounds of chewing gum. This represents a per capita consumption in the United States of about three and a half pounds, or fifty-five packages per annum. Every man and woman, old and young, boy and girl and infant in arms represented a consumption of fifty-five packages of gum last year! Great is the power of the American jaw! No wonder we are a race of orators.—ELLWOOD HENDRICK.

A Portable Nail Distributor Saves the Carpenter's Hands and His Time

A BOON to the traveling carpenter, in the form of a portable nail distributor has been invented by Robert B. Holland, of North Yakima, Washington. With it the carpenter or other workman can separate small nails from large ones by simply dropping them into a hopper. The various parts of the device are easily collapsed into a compact package of a convenient size for carrying.



A portable nail sorter which will arrange nails and tacks according to their size

To distribute the nails according to their several sizes, the nails are first placed in the hopper and fed downward to the chute by jarring the casing. The nails strike the partitions and are deflected out through the openings in the bottom into the guideways. Here they collect, according to their size, and the operator grasps them by the thumb and forefinger.

Conquering Your Cramps Under Water

Some valuable first-aid advice from the champion long distance swimmer of the world

Breaking the arm cramp by sheer strength. The lungs are first filled with air to prevent panic; then the arm is forced out straight

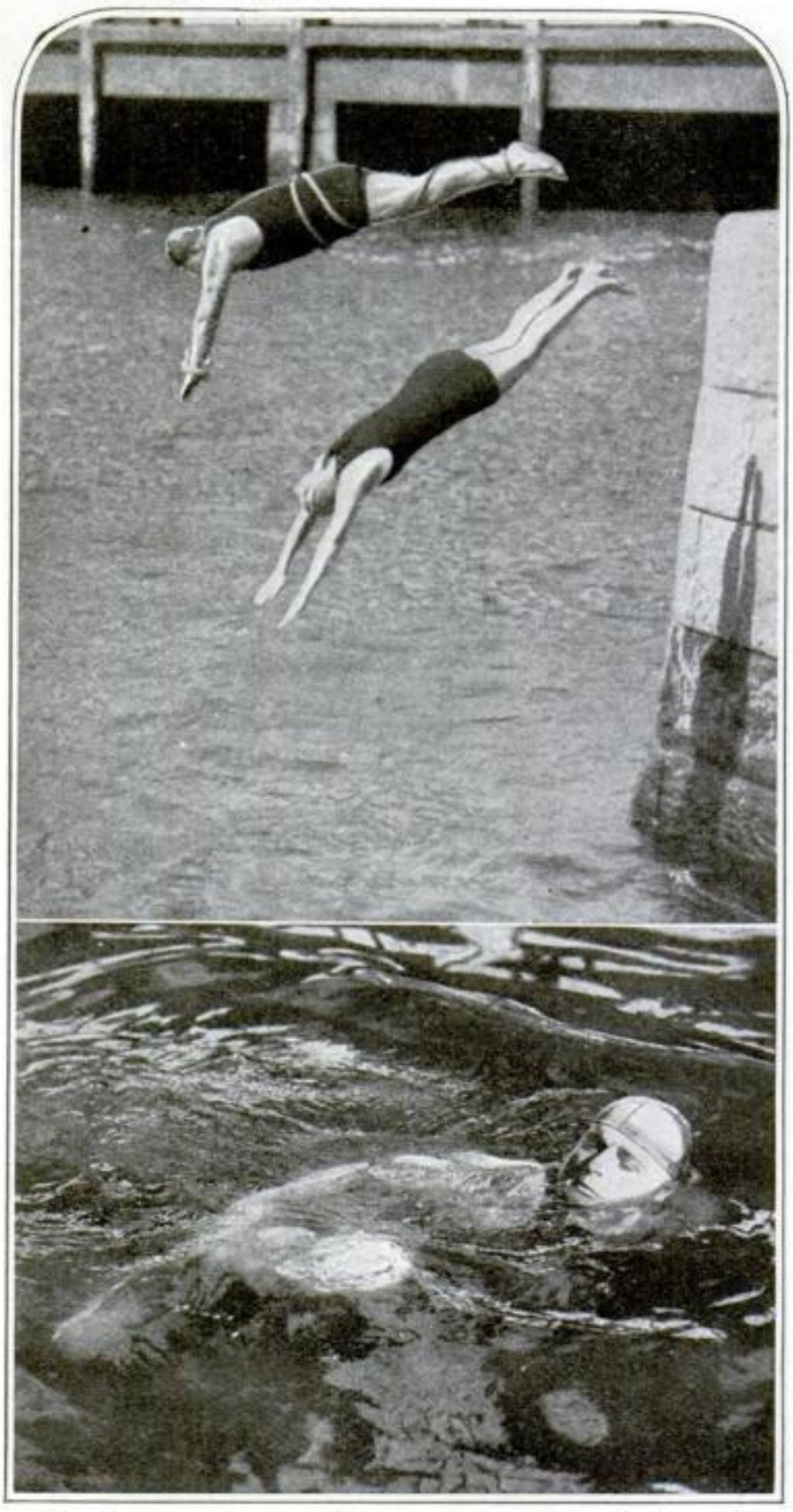
THE "Old Man of the Sea," who figures in fiction so mysteriously and with such dire consequences, might well be named "Cramps" for everyday application, as far as swimmers are concerned. To many swimmers, otherwise absolutely fearless in the water, the suspicion of a cramp is a nerve-wrecker. But, according to Henry Elionsky, holder of the world's long distance swimming championship, that is because they do not employ the scientific method of breathing when in the water.

The rule which Elionsky gives to his pupils at the Brighton Beach Baths near New York is: "When in the water breathe through the mouth only and gulp the air, as you would if you were frightened or very much amazed on land." The air thus inhaled is driven into the lungs in about five times the quantity rate breathed through the nose.

A cramp is merely a contraction of the muscles caused by the penetration of the cold. Obviously, it could not of itself cause drowning. Its worst effect is to cause a panic which throws the swimmer off his guard, causing him to let the air out of his lungs and thus allow the air passages to become filled with water. The safeguard against such a panic is absolute confidence in the floating power of the body and a demonstrable knowledge of the proper way to quickly fill

Below: Henry Elionsky swam from Battery Park, New York, to Coney Island, with hands, feet and legs shackled. Time 5 hours, 20 minutes. His sister, with hands and legs free, accompanied him. Here they are diving from the Battery pier

Photo © Central News



Forcing a cramped leg straight. The body will float as long as the lungs are kept filled with air

the lungs to utmost capacity with air.

The moment a cramp is felt, the swimmer should turn on his back and begin to gulp the air, making no effort to keep himself from sinking. As he sinks he slowly exhales under water, through the mouth, with the lips puckered as for whistling. If it is a stomach cramp the knees will be drawn up against the abdomen, but the swimmer should force them out, pushing on them with both hands and using all his strength until they are fully extended. This will no doubt cause great pain for a few seconds, but as soon as the legs are straightened out the cramp will vanish, and the body, buoyed up by the air in the lungs, will shoot up to the surface. There, still inhaling in great gulps and exhaling through puckered lips, the swimmer may float until he regains his strength or is picked up.

When the cramp is in the stomach, turn on your back, gulp the air to fill the lungs and push the knees down

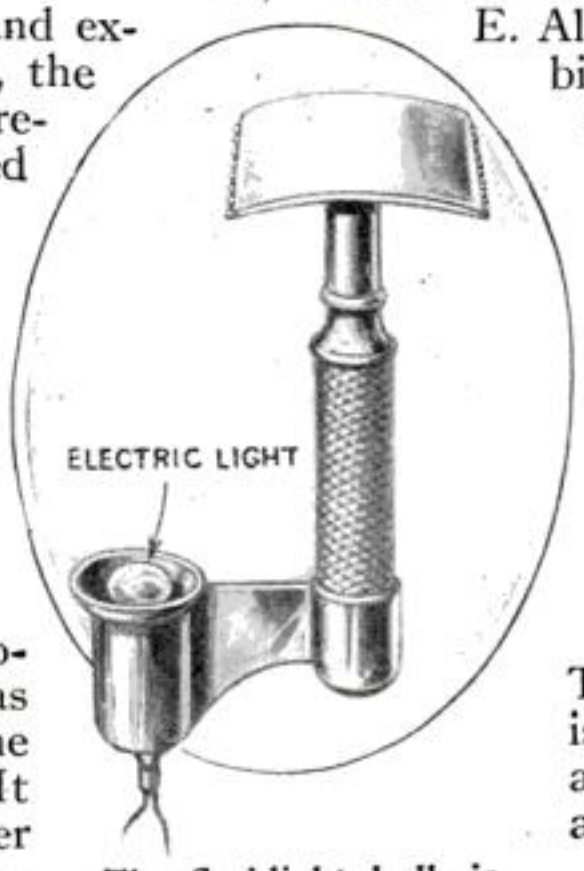
In case of cramp in the leg or arm the same system of breathing is followed and the affected part is straightened out by sheer strength.

The Very Biggest Locomotive in the World

THE greatest steam locomotive in the world has been put into service by the Baldwin Locomotive Works. It is so gigantic that its boiler had to be made flexible at three different joints so that the locomotive could turn around a curve! It is over one hundred feet long and weighs some four hundred and twenty tons. Twenty-four driving wheels, each standing as high as an average-size man, afford it traction. The driving wheels are distributed along the length of the locomotive in sets of four pairs, the wheels of each set being coupled together and driven by two giant steam cylinders. Under full steam, the locomotive can exert an eighty-three ton pull on the cars behind it—which means that it can easily haul a freight train two miles long and twenty-three thousand tons in weight over an ordinarily good road-bed at an average rate of about fourteen miles an hour and possibly more. Bad roads will retard it only slightly.

Shave Under a Flashlight Attached Directly to Your Razor

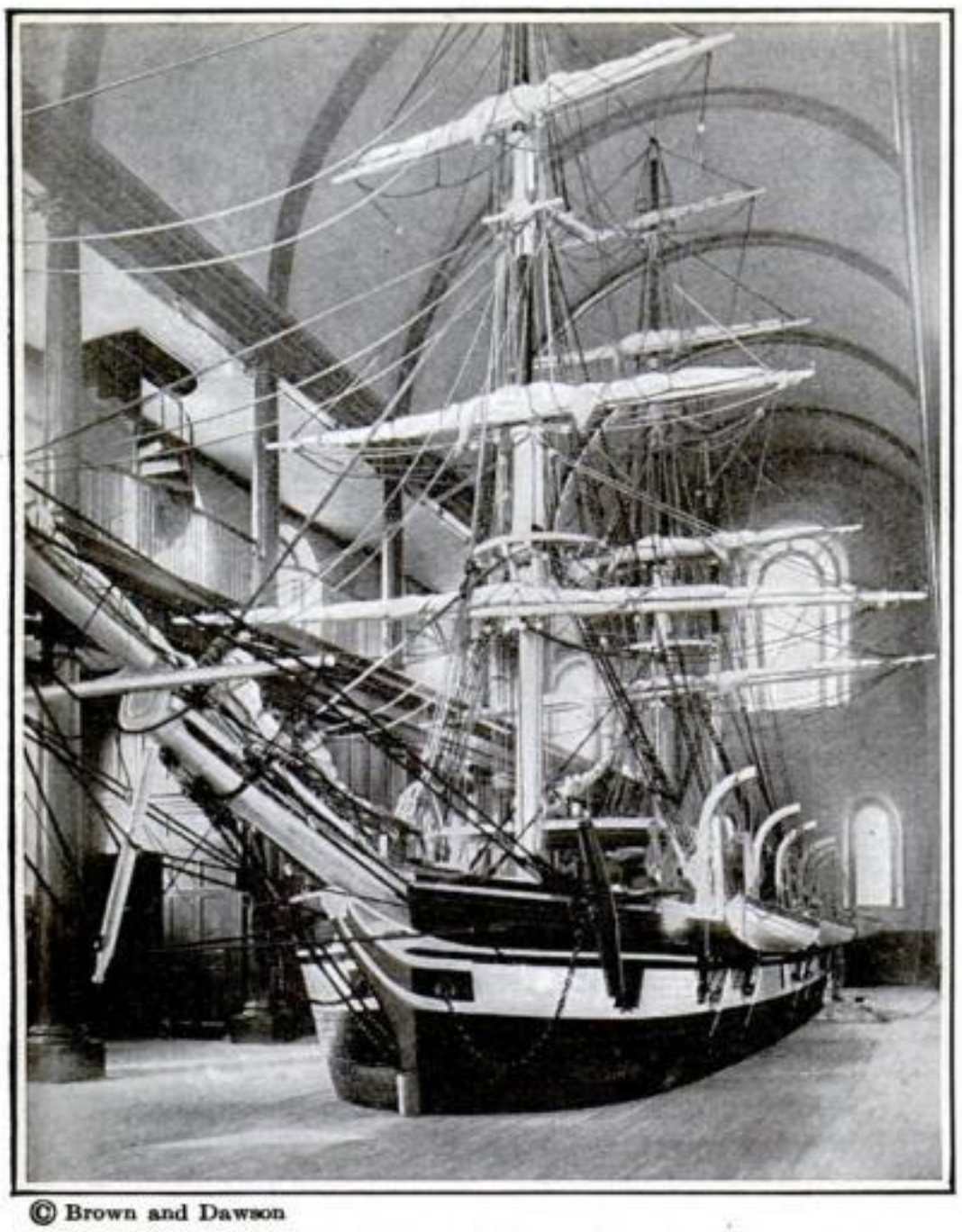
"FIRST AID" in affording yourself a quick shave is given by a new razor attachment patented by Katherine E. Allport of Chicago. It is a combination of a flashlight and a razor which will illuminate a man's face far better than the regular wall light.



The flashlight bulb is clipped to the end of the handle of the safety razor and throws the rays across its path

A wall light which is directed upon one half of the face cannot intensely illuminate the other. But by having the light attached directly to the razor, the light follows the blade and the strong rays are thrown just where they are needed. The chance of cutting yourself is thereby reduced considerably, and a perfectly clean shave is assured.

The small flashlight bulb is clipped with its socket on to the handle end of the razor. The conducting wires from the socket lead to small dry cells which occupy the bottom half of the razor box especially built for this attachment. From one to three dry cells can be employed, depending upon how much light you consider necessary for the operation.



© Brown and Dawson

A life-size model of the whaling ship, Lagoda, which was built in the room in which it is exhibited

The Largest Model of a Ship Ever Constructed Under a Roof

IN the days when the American merchant marine was the pride of the entire shipping world, New Bedford, Massachusetts, was the port of many a prize-winning cutter. It was also the headquarters for the whaling industry. One of the early sea captains who made a fortune out of whale oil was Jonathan Bourne, whose favorite ship was the *Lagoda*.

When Jonathan Bourne died he ordered a model of the *Lagoda*—the largest model of its kind in the world—placed in a museum known as the Jonathan Bourne Whaling Museum. His daughter, Emily Howland Bourne, contributed fifty thousand dollars to carry out her father's wishes. The model is complete in every detail, even to small whale boats which hang from the davits. It measures fifty-nine feet from the figurehead to the stern, and it is eighty-nine feet from flying jibboom to spanker boom. The cost of the model alone was twenty-five thousand dollars.

The Curious Ways of Egypt's Holy Beetle

THE holy beetle of the Nile is found carved in stone everywhere in Egypt—a relic of a time when crocodiles, bugs, and beetles were objects of worship. As the scarab is a dung beetle it is naturally found in the vicinity of herds and particularly in pastures where nomadic herdsmen watch their flocks.

The scarab is not satisfied with merely eating manure on the spot, as are most dung beetles. It fashions perfectly rounded balls out of manure and rolls them often considerable distances and buries them in the sand.

These dung balls serve the scarab and its brood as food. It makes several balls for itself, and others similar in appearance for the brood. All are buried in the sand. When making a ball for the young the beetle is exceedingly careful in the selection of food. It rejects all undigested vegetable particles. The ball is fashioned into pear-shape after having been placed in the excavation made to receive it. A single egg is laid in a small receptacle in the elongated part of the pear. The larva, slipping from the egg, eats out the interior of the greater part of the ball, leaving a hollowed-out portion inside of the hard outer crust. Within this shell the chrysalis stage is then passed.

—Dr. E. Bade.

The scarab rolling a ball of manure many times its own size to a suitable hiding place

With an Axe and Two Springboards He Chops His Way Up a Giant Tree

FROM the logging camps in the vast timber district of Vancouver have come some remarkable accounts of daring and agility. The story that is going the rounds of the camps just now is the tree-climbing feat performed by a powerful lumberman, Andrew Busby. A cable had to be attached to a tall tree at a point one hundred and twenty feet from the ground. With pole-climbing spurs and belt this would have been a simple task, but no such equipment was available. How was it done?

With an axe and two springboards Busby began to climb the tree. Using the first board as a platform he chopped a notch five feet above him, slipped the second board into the notch, climbed up, and, pulling the first board after him, continued the operation a score of times. Within an hour he stood on the last springboard, at the top of the tree, and affixed the rope, his companions yelling their admiration in the meantime. Standing more than a hundred feet above the ground on a little platform a few inches wide he was apparently as calm as he was when on the solid ground.

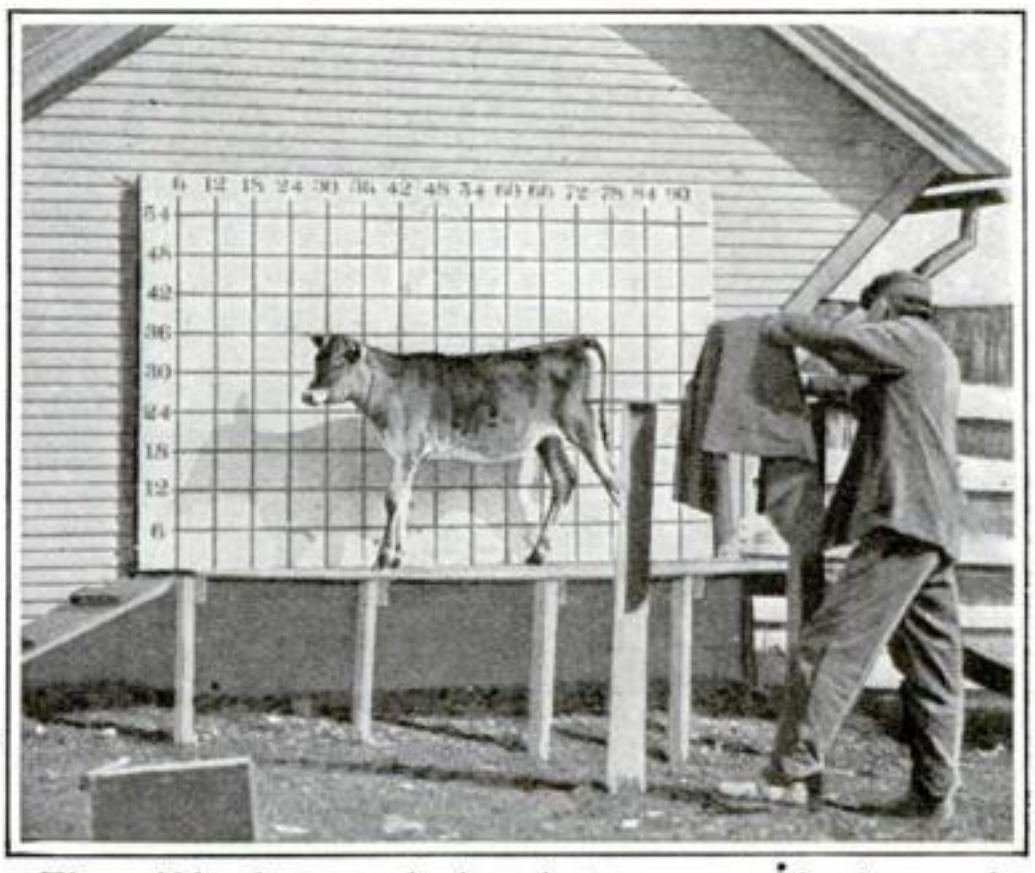
With an axe and two springboards Busby climbed to the top of a 120-foot tree cutting grooves into which to insert his board at five-foot intervals

Needless to say, Busby is an expert chopper, skilled in the use of the springboard and is possessed of the fearlessness natural to the woodsman. His claim to the title of champion tree-climber has not yet been disputed nor is it likely to be, according to his fellow workmen.

Studying the Effects of Calf-Foods by Means of Photographic Records

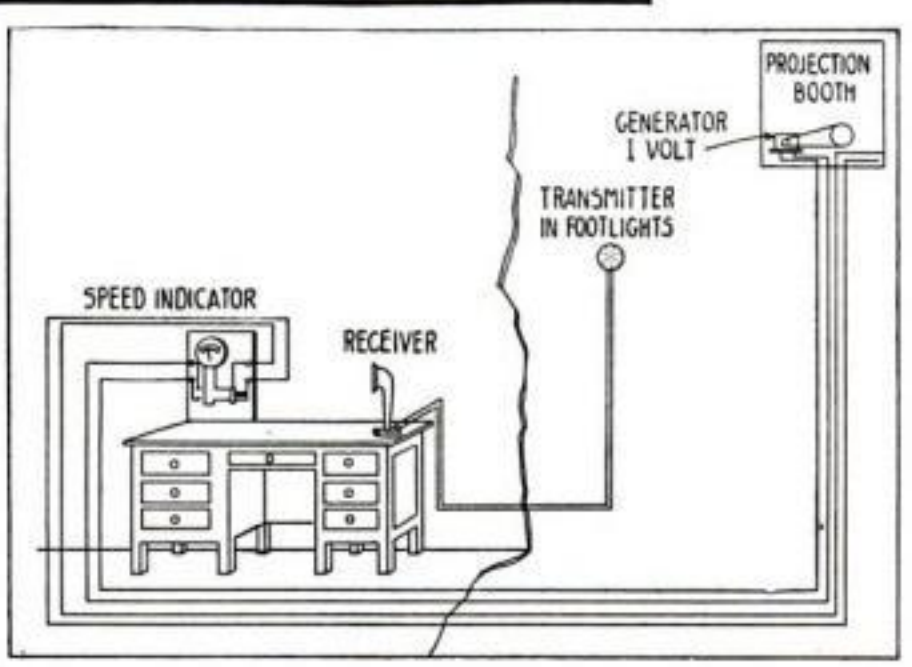
IN keeping records of experiments to determine the effects of various foods and combinations of foods as substitutes for whole milk in the rearing of calves the Agricultural Experiment Station of Purdue University, Lafayette, Ind., uses photographs instead of tabulated figures to furnish an index in regard to the condition and development of the calves.

The photographs are made at intervals of thirty days during the first six months. The illustration shows the equipment used in securing the pictures. The background is divided into six-inch squares to designate the height and length of the calf. In order to secure contrasts in the photographs of calves of different breeds, a black or a white background is used according to the color of the calf. The camera is placed on a stationary support and is situated at a uniform height and distance from the background for each exposure. No special attention is given to the calf on the day it is to be photographed, so that the picture may represent its ordinary condition. When all preparations have been completed for the picture the calf is led up to the platform in front of the chart. When it reaches the center of the platform a helper on the other end waves a cloth or coat in front of it, just enough to cause the calf to pause and consider whether it is wiser to go forward or back. During that second the camera clicks.



The calf is photographed against a squared background at regular intervals to obtain records of its growth

Mr. Harold Edel, Managing Director of the Strand Theater, New York city, attending to business in his office and following the progress of the show at the same time. At right is shown the details of the electrical devices by means of which the director can keep in touch with the stage and audience



switch, the director can hear the orchestra and the soloists as well as if he were one of the audience.

When a certain motion picture is scheduled on the screen, the director connects up the speedometer near him with the motion picture projector in the gallery. This meter is similar to those used on automobiles, except that it indicates feet of film per second instead of miles per hour. Hence, the director instantly can find out when the operator fails to run his picture at the proper speed. The operator can then expect to hear from the director—who merely speaks into the telephone transmitter mounted in the same box as the detectaphone receiver. By means of this same transmitter the director can get in touch with any part of his theater when giving his orders to "ginger up" the show.

Directing a Motion Picture Show From the Manager's Office

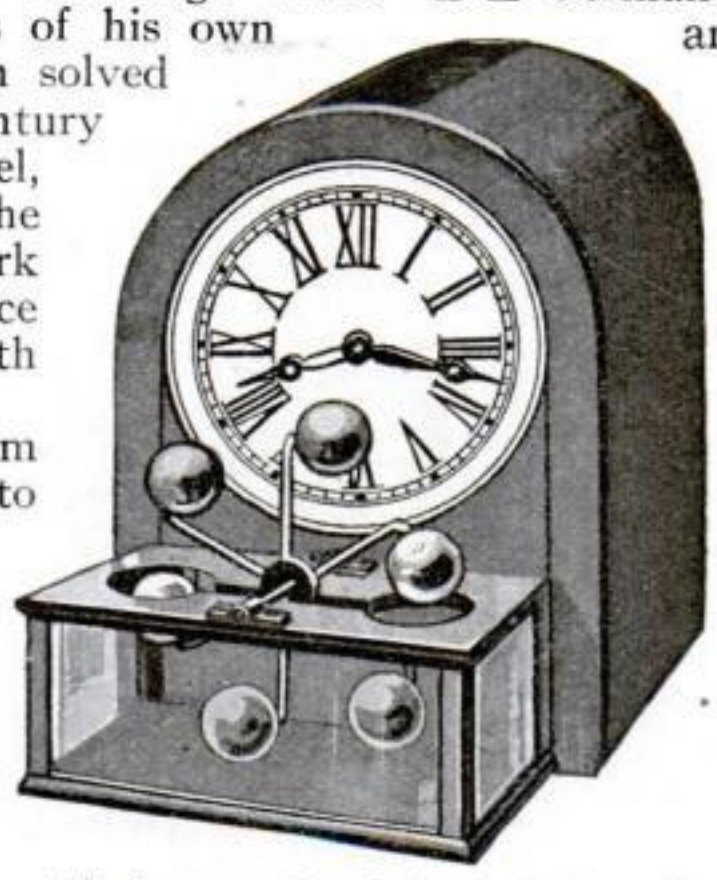
THE problem of keeping in touch with the audience and the stage while attending to the affairs of his own private office, has been solved in a very Twentieth Century way by Mr. Harold Edel, managing director of the Strand Theater, New York City. He sits in his office physically; he sits with the crowd electrically.

A detectagraph leads from the footlights of the stage to a loud-speaking receiver mounted in a box on the manager's desk. This transmitter is like the concealed telephone instrument by means of which detectives listen to the conversations of criminals. By the throwing of a

The Evaporation of Water Drives This Remarkable Clock

A CLOCK designed by M. Bernardi, a German watchmaker, is run by ether and water. The driving wheel consists of three glass tubes having light glass balls fused to their ends. Some ether vapor is contained in each tube system. The water is contained in a reservoir, through which the balls pass when turning.

An outside covering of cloth on the balls carries up a film of water when the balls turn out of the reservoir. When water begins to evaporate the temperature lowers. This lowers the pressure within the upper balls. The ether vapor in the lower balls rises upward as each cooled ball rises.



The waterworks of the clock depend upon the evaporation of the water and the expansion of the ether vapor

A Puncture-Proof, Bullet-Proof, Blow-out-Proof, Skid-Proof Tire

FROM Washington there comes the photograph which is reproduced herewith, showing a Seattle citizen's ideas on keeping pneumatic tires out of harm's way and yet getting a little more service from them than could be obtained if they were locked up in a dark room in an atmosphere of nitrogen. To accomplish his purpose the inventor uses 100 to 150 pounds (estimated) of a "special grade steel" for each tire, which might seem excessive to the ordinary mind, but, having done so, he has the satisfaction of announcing that the tire by this heroic means is rendered non-skid, puncture-proof, bullet-proof—"of great benefit to the warring countries"—stone-bruise and blowout-proof and is endowed with four ordinary rubber-tire lifetimes. Incidentally, in case that anybody should venture to place a wagon-wheel steel tire in bold competition with his invention, he assures you that it will wear out three such, this referring perhaps mainly to a special type of his protector which he has taken the extra trouble of devising for "un-inflated" rubber tires.

Encased in this armor a tire should have a chance to die of old age

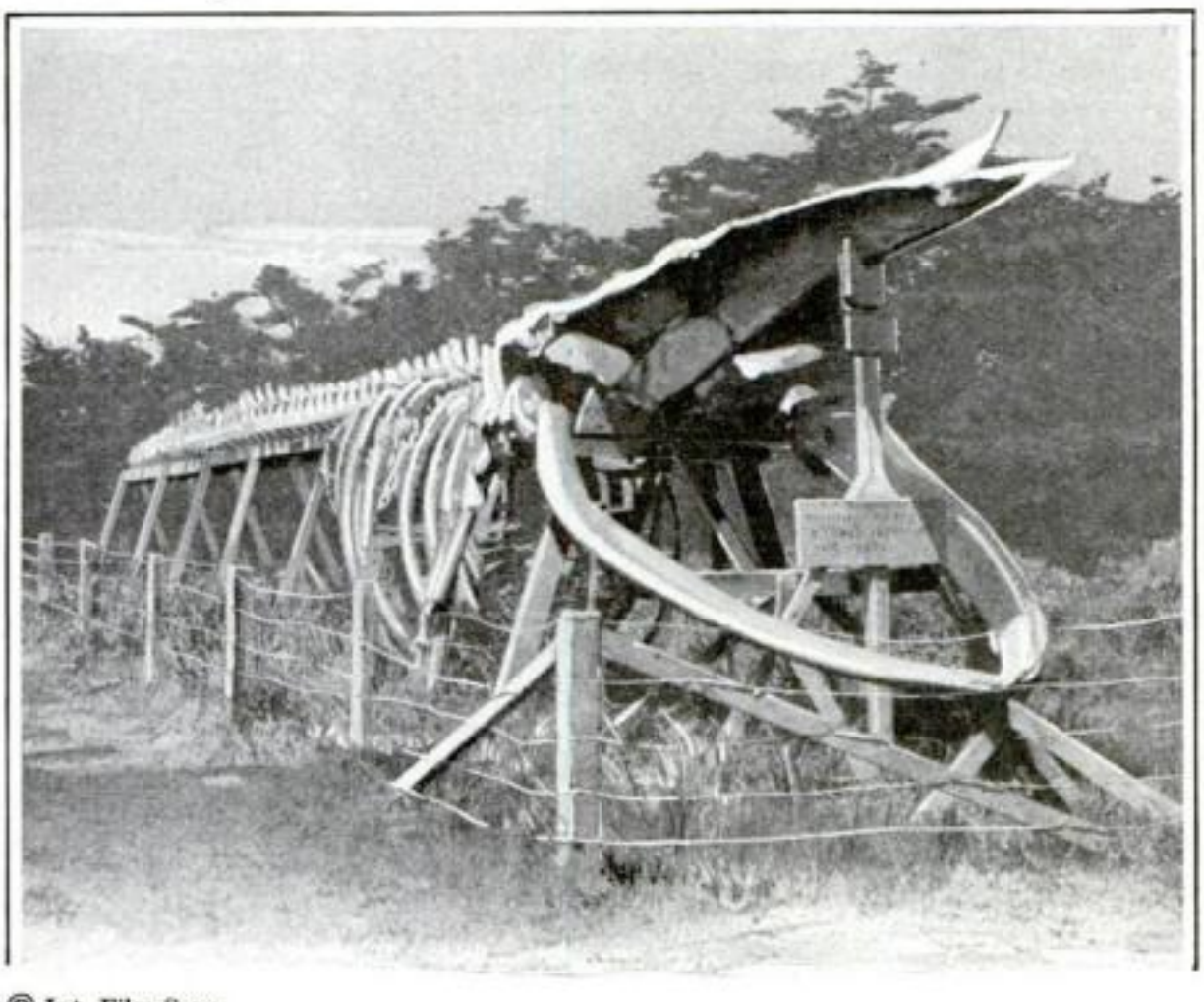
The question arises: Given leeway to use 100 pounds of extra material, could a tire-maker produce anything better than this protected tire? The inventor apparently challenges them, one and all. He bravely uses thirty-six steel spacers draped around the tire six inches apart, and on this formidable base he strings about thirty feet of heavy coil springs and forty feet of lighter grade, whereas one lock, three clamps and twelve rods with threaded joints serve to hold the armor so formed tightly against the heaving breast of the poor tire, ordinarily so much abused. Springs are springs, he reasons, and keep the natural resilience of the tire unimpaired, even if expected to work crosswise. Careful inspection of his photograph reveals, however, that steel rope is used instead of the lighter coil spring along the least visible portion of the circumference, but this is apparently an emergency arrangement for publicity purposes only.

How Monterey Turned a Whale into One of the City's Sights

MONTEREY, California, has solved the question of what to do with a stray whale that is washed up on shore. After disposing of the flesh and oil to a refinery, the bones may be mounted on shore and kept as a permanent natural history exhibit.

That is what the city officials did with a whale which was washed ashore there. It was welcomed with open arms and the bones were saved as an educational feature for the benefit of the school children of the city and for interested adults.

Since there was no building available large enough to accommodate it, it was set up in an open lot and fenced in.



© Int. Film Serv.

The spinal column of the whale mounted for exhibition at Monterey consists of forty-six sections. There are fourteen ribs

What's On the Moon?

Look through the telescope with us and see the great mountains, the vast dead craters and arid wastes of slag

By Scriven Bolton, F. R. A. S.

Illustrations specially prepared for Popular Science Monthly by the author

SUCH is the power of our largest telescopes that a creature as large as an elephant might be detected on the moon. Hence we are more familiar with the lunar surface than with Central Africa. Since there is no appreciable air on the moon, our view is always clear and unobstructed.

Why has the moon no atmosphere? Simply because the force of gravity is so small. The weight of an object on any planet depends upon the mass of that planet. On Jupiter, the largest of all planets, you would have difficulty in lifting your arm from your side. On the Sun you would probably need a steam crane to help you move about. On Mars you could jump over a small house. Small planets, including the earth, are gradually losing their atmosphere. The smaller they are the more rapid is that rate of loss. And since the moon is very small, it lost its atmosphere long ago. Thus is to be explained the fact that the earth is still wrapped in air although the moon, child of the earth though it is, is airless. Because of this entire absence of air astronomers consider it improbable that there is any lunar life. Perhaps there may be remnants of vegetation within certain low-lying craters and in the deepest valleys and chasms where a few shreds of atmosphere may still pervade. But nothing of the kind has as yet been detected, and as we gaze in bewilderment into every crack and crevice of the surface we rightly conclude that the moon is a truly barren world.

On Top of a Lunar Mountain

Although we cannot fully realize existence on the moon, it is nevertheless the inevitable experience of the astronomer when telescopically raking the lunar surface with what might be justifiably termed an eye of the earth to identify himself to such an extent with the scrutinized scene that he ofttimes unconsciously thinks himself a lunar inhabitant. It really requires but little imagination to suppose oneself actually planted among the lunar craters and mountains, viewing in awe the wonderful landscape.

Now let us endeavor to realize, by the help of the accompanying illustrations, that we have taken our stand upon one of the mountain peaks such as we see in these pictures, and by commanding an extended view of the surroundings we duly note the strange lunar conditions produced upon the landscape.

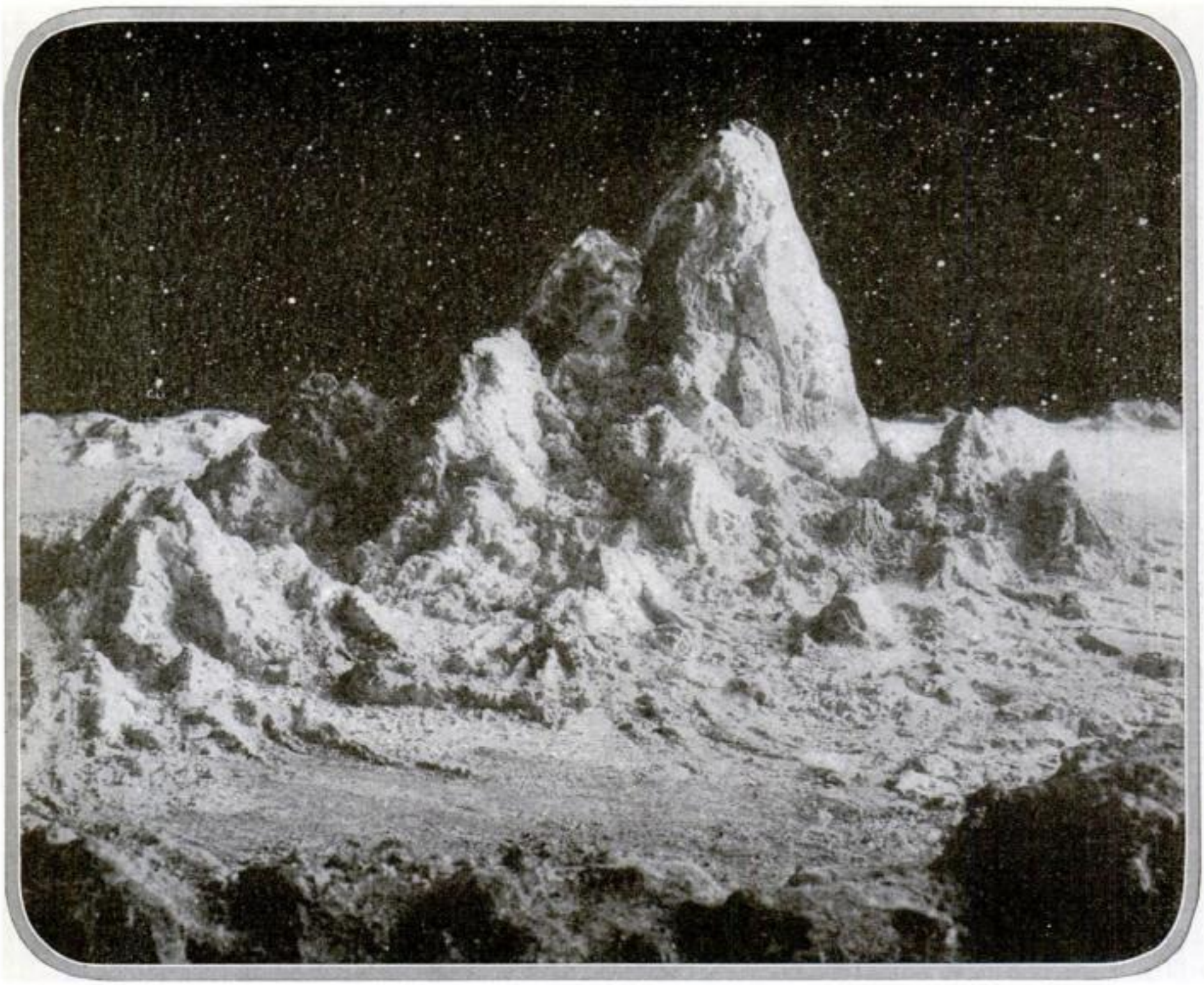
Dawn Is as Harsh as Midday

The lunar day is thirteen times longer than ours. Dawn, in an earthly sense, is unknown, for there is no atmosphere to reflect the solar beams while the sun is yet below the horizon. The terribly harsh solar beams suddenly appear on the black horizon, dazzlingly illuminating the mountain crests, while the valleys are still in utter darkness. Because there is no atmosphere, blending of the night into day at sunrise is unknown, and all the gorgeous tints which attend a terrestrial sunrise are on the moon quite absent. On earth we are accustomed to see the sun's light softened by an air screen. The fierce splendor of our luminary on the moon, however, is rendered more obvious by the blackness of the sky, owing to the absence of air. Even in broad sunshine the sky is as dark as our darkest starlight nights, with the stars and planets shining more brightly than it is possible to see them here. The appendages to the sun, such as the Zodiacal Light, the Corona, and the red protuberances, appear in glorious perfection.

What a magnificent object is the earth, thirteen times larger than the moon appears to us, and practically stationary in the heavens! It exhibits phases precisely as does our moon, the interval between each full "earth" being about twenty-nine days. The sublime and periodical spectacles of a total solar eclipse and an eclipse of the "earth" are attended by circumstances far more imposing than their earthly counterparts. The spectator sees the earth-globe rotating on its axis, the continents, oceans, and polar snow caps being well displayed. Portions of the surface appear inter-

How the "Full Earth" Looks from the Moon

The long lunar night, which comprises thirteen of our nights, is substantially relieved by the reflected light of our globe, which at full "earth" radiates thirteen times more light than the moon does to us. The landscape depicted here is characteristic of many regions on the moon, showing the surface strewn with volcanic craters varying in size from a few hundred feet to many miles in diameter, some possessing a central cone. The moon swarms with these objects

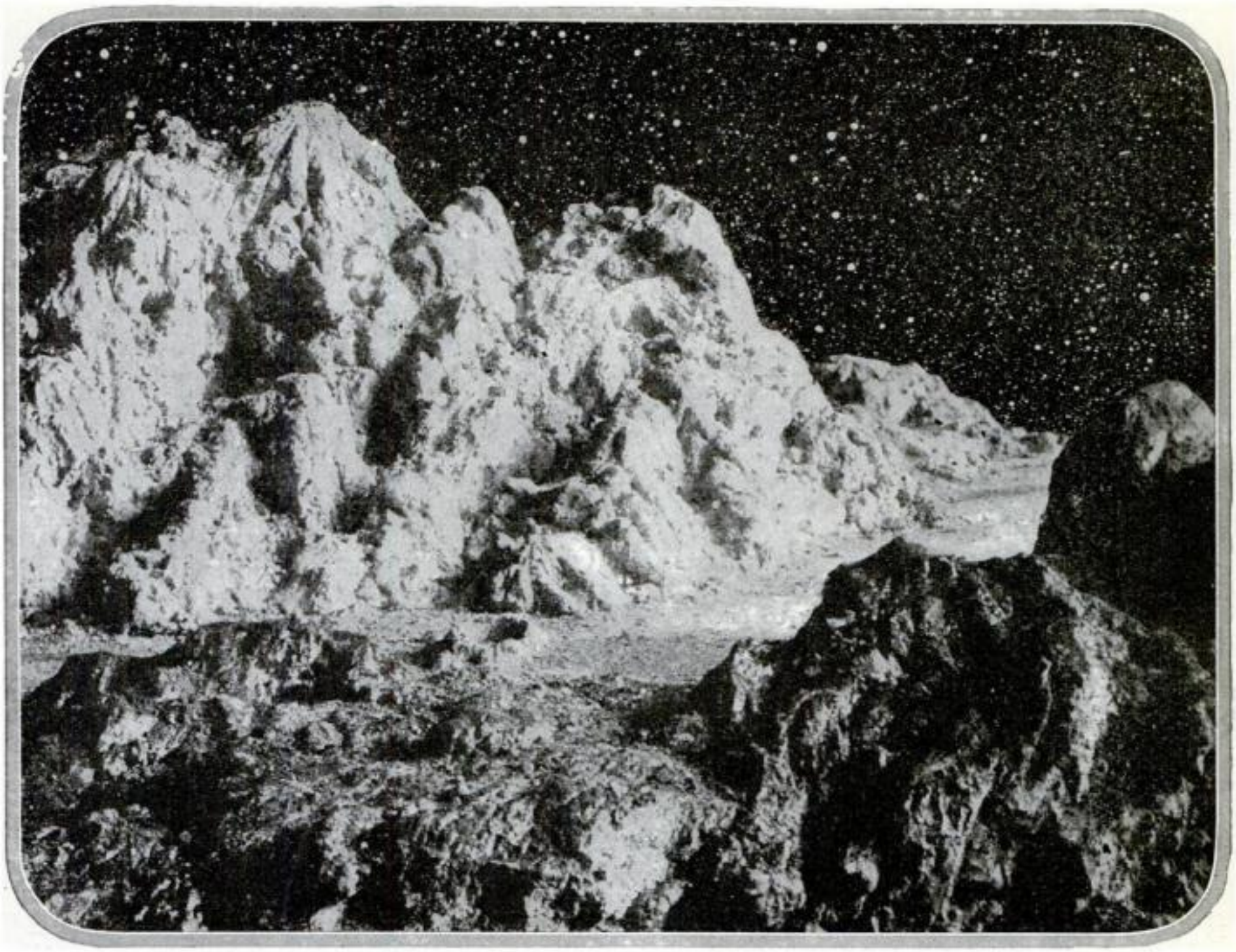


An isolated mountain at the north terminus of the Apennines. Rising 15,000 feet above the plain it is but one of scores of similar solitary peaks, the sublime grandeur of which cannot be overestimated. Even at midday the sky is darker than on our darkest starlight nights, with the stars and planets shining brighter than it would be possible to see them from our earth

mittently obscured by slowly-moving white vapor in the terrestrial envelope, lying usually in long streaks roughly parallel to the equator.

The Terrible Desolation of the Moon

And now assuming that we have planted ourselves upon a more elevated portion of the moon, our attention, which has been directed to the sky, is now concentrated upon the surrounding landscape. We behold everywhere a scene representing the wildest desolation. The shadows assume total blackness and appear quite impenetrable to one's vision; for absence of an atmosphere means no diffusion of light. In stepping behind a bowlder or any other part which does not receive the direct rays of the sun, one becomes invisible. Volcanic cones, ranging in diameter from a few hundred feet to many miles, literally crowd the surface as far as the eye can reach. At a distance of forty miles or so the summits of a gigantic mountain range are seen peering above the horizon, and as clearly defined as the adjacent neighborhood. It is difficult if not nearly impossible to pass correct judgment on the distance of the various features owing to the lack of aerial perspective. The region close by is seen to be composed chiefly of hills of volcanic debris, rocks, bottomless pits, yawning crevasses and piles of slag—doubtless a scene of inconceivable commotion in ages antedating mortal history, but now a world devoid of sound or disturbance, and minus evidence of organic life. Indeed we realize that we are in touch with a world which is typical of a dream of lifelessness, an apparition denoting not death, but a world upon which life has never appeared. No atmospheric elements have been at work to tarnish the pristine hues of many parts



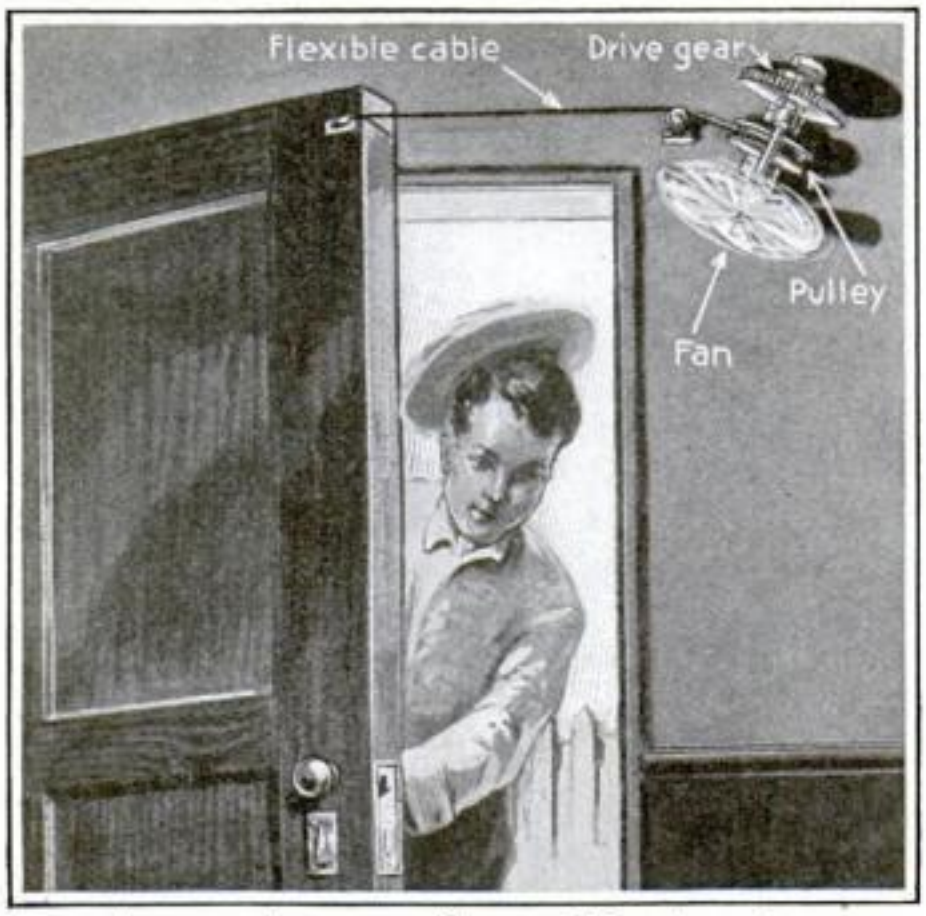
The Valley of the Alps. This flat-bottomed valley is over 70 miles long and is about 6 miles wide at its broadest part. It is bordered by majestic and precipitous mountains, the peaks of which attain an altitude of 9,000 feet above the valley. Rugged hills in the immediate vicinity, as shown in the foreground, indicate piles of slag. A scene of dreary desolation, even with the noon sun shedding its overpowering light, although at some very remote epoch one of inconceivable commotion. The entire region appears to have passed through the fiery furnace

which bear every evidence of having passed through a fiery ordeal. The entire surface is one of dreadful contrast; the dazzling brightness of the landscape compared with the hard black shadows; the black sky, even at noon, with the sun shedding a ghastly overpowering light; these conditions, together with no trace of life, form a scene of dreary desolation, but nevertheless one of sublime grandeur.

The Deathly Silence of the Moon

Although the sun pours his heat upon the surface throughout the long lunar day, which comprises over three hundred of our days, yet the rocks remain too cold to touch with safety. Everywhere there reigns the silence of death. Occasional landslides, cracking of the surface and shrinkage commotions, dislocation of piled up volcanic debris, all occur without an attendant sound. Because there is no air we cannot hear. Ten thousand volleys might be fired instantaneously, with a resultant vibration of the ground, but the prevailing silence would remain unbroken. It is indeed a world possessing conditions just the reverse of our own. Imagine there to be no water, no air, nothing to sustain life for a single instant!

We see a world of mystery and destruction, riddled as is its surface with volcanic formations representing primeval forces, but maintaining their original characteristics and freshness owing to the absence of disintegrating elements. Nevertheless, it teaches one grand lesson in that it "exalts our estimation of this peopled globe of ours," writes Carpenter, "by showing us that all planetary worlds have *not* been deemed worthy to become the habitation of intelligent beings." So we mentally "come back to earth," perfectly content to have taken only an optical flight to the moon.



Any venturesome flies seeking to enter when the door is opened will be blown away by a blast of air from the fan

Keeping Out Flies When You Open the Door

A DOOR-OPERATED fan which drives away venturesome flies has been brought out by Joel J. Hurt, of South Omaha, Neb. The bracket holding the fan is attached to the door jamb at the top of the door. The gear of the fan engages the driving gearing mounted on another shaft. This driving-gear shaft carries a small pulley on its lower end. A flexible cable wound upon this pulley is attached to the door. When the door is opened the unwinding of the cable operates the fan. The gearing is made high so that the fan is whirled rapidly.

An automatic clutch disconnects the fan from the pulley when the door is fully opened. Momentum keeps the fan rapidly turning until the door is closed. A strong spring, which was wound up with the opening of the door, causes the door to close automatically.

If Your Parrot is Thirsty, Give Him a Drink

"THERE is a curious superstition existent among parrot-keepers," says L. S. Crandall, in *Pets* (Henry Holt & Co., New York), "to the effect that these birds not only require no water but are better off without it. The foundation for this absurd belief is not hard to find. When parrots, particularly young birds, are being brought from the tropics, they are customarily fed on boiled corn or bread and milk. What moisture they require is obtained from the food. If such birds are suddenly given access to unlimited water, the effect on the digestive organs is dangerous, and may result in the death of the bird. On the other hand, if the parrot be given a drink daily, and then the water be removed for a short period, the bird will gradually become accustomed to it. Once this is accomplished, there is nothing to fear from clean water."

An Accommodating Church—It Goes Wherever It Is Wanted

IN India and in some places of the New World, particularly in the British West Indies, many religious festivals are held along the roadside and in the open fields during the month of February, which is the month of weddings and special feastings.

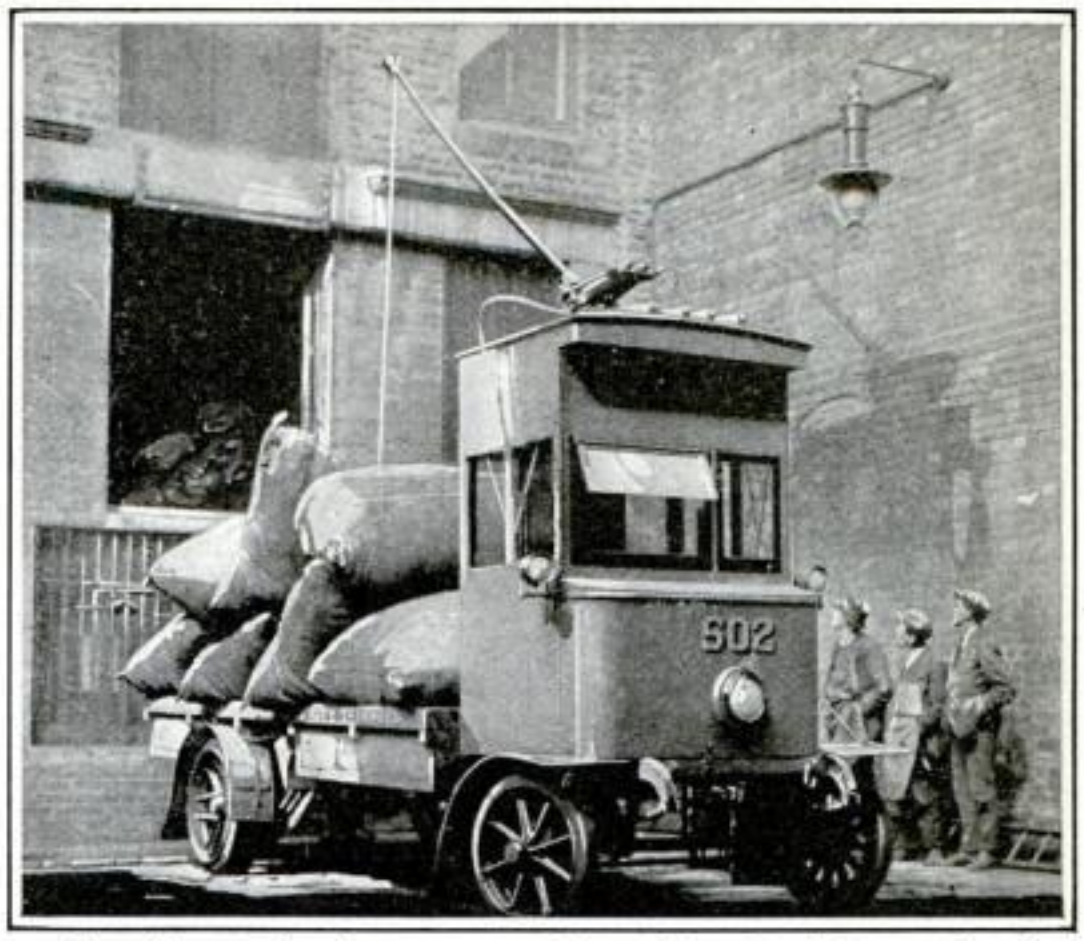
On such occasions the participants in the ceremonies do not go to church. The church comes to them. Ornate structures of papier mâché are used for the purpose, and these traveling temples are drawn through the streets and country roads by religious devotees, who will stop when called upon and hold a service or deliver prayers for a small sum.

Such temples take a conspicuous part in all parades and religious celebrations.

Carrying the temple through the streets of India. During the month of February it is in great demand for wedding celebrations

One Horsepower Will Run All the Watches in the World

AN astute French mathematician has found that in certain watches the motions exceed two hundred million a year in little equal jumps. In the same time the outside of the average balance travels seven thousand five hundred miles. Yet despite this astonishing distance traveled by the ordinary watch the amount of power consumed is trifling. One horsepower is sufficient to run two hundred and seventy million watches. This is probably all the watches that are in existence. But if there should be more there would be enough power left in the one horsepower to run an additional thousand watches or so.



A self-contained motor-truck equipped with standard electric street car trolley pole and a storage battery

The Latest Conceit in Timepieces—A Buttonhole Watch

IN spite of the fact that there is no article of jewelry more useful than the watch, it seems hard to stow it away in a suit of clothes. It has been tucked away in vest pockets and belts, attached either to an ornate chain or an inconspicuous ribbon, and has adorned the wrists of all classes.

But the very latest and most conspicuous location yet chosen for it is in the buttonhole of a coat lapel. The buttonhole watch is necessarily tiny, and fits into a gun metal case which resembles a large-sized collar button in shape. When worn merely for the convenience of the owner the watch is usually turned upside down so that the time may be seen at a downward glance, without even lifting the lapel of the coat.

It is said that the diminutive size of the watch does not interfere with the accuracy of the works. The principal objection to wearing one of them just now is that the buttonhole is needed for flag emblems and liberty bond buttons.

The buttonhole watch fits into a case resembling a large-sized collar button

Making a Trolley-Car of the Motor-Truck

WHY can't motor-trucks and other commercial vehicles obtain their power from overhead trolley wires? So they can, if reports from Bradford, England, are true.

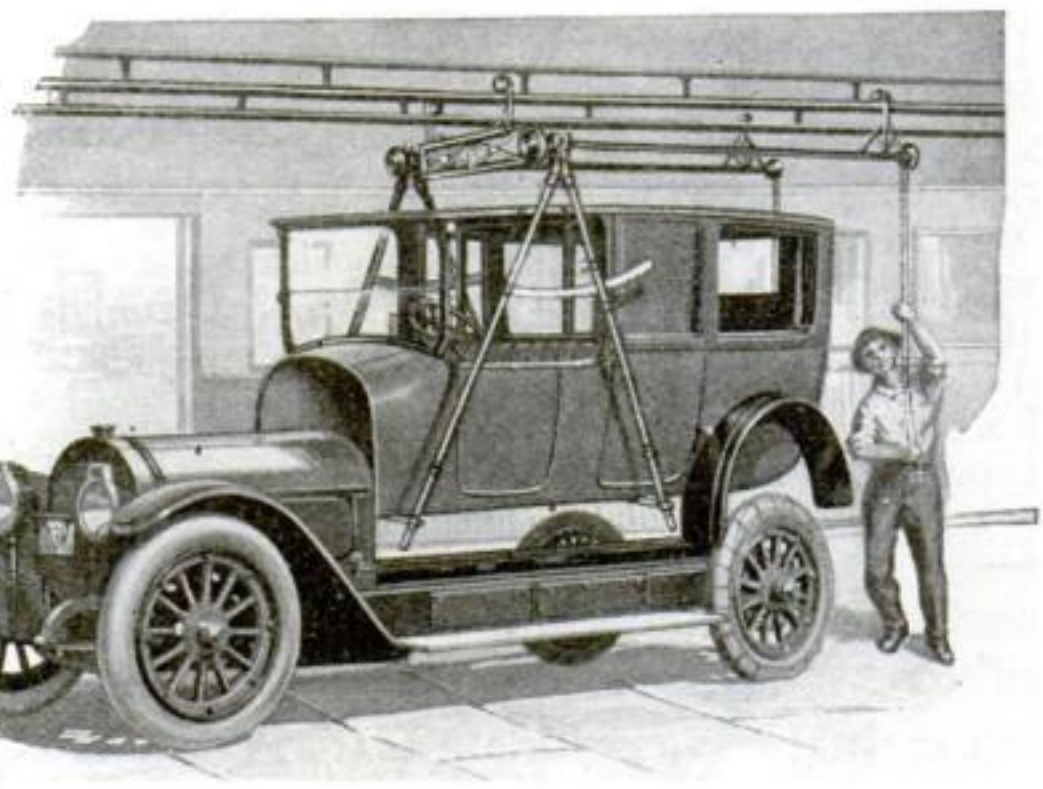
In Bradford a motor-truck with a trolley pole attached to its cab takes power from overhead street car wires. The truck runs along on the street-car tracks, contact with the rails being made by means of a cast-iron block to the steering gear. This block also steers the vehicle.

When the truck reaches the end of the street-car tracks, the rail contactor is lifted, the trolley pole pulled down, and the storage battery is brought into action. The truck then continues on its way as a self-contained vehicle. The motors are of twenty horsepower. The battery is arranged so that it can be charged with street car current when the truck is running. On one charge of the battery the truck can run for about ten miles.

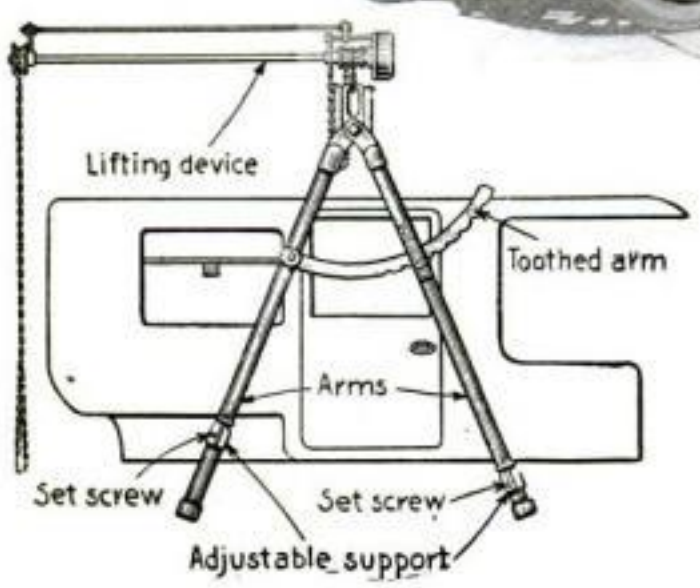
Device to Remove Automobile Bodies Without Scratching Them

TWO men can remove a highly-polished automobile body from its chassis without giving its surface a scratch, by means of the device shown in the accompanying illustration.

This new device is attached to an overhead trolley. It consists of two sets of compass-like arms pivoted to the ends of a common cross-member at the top. The arms of each set may be spread out to reach the front and rear ends of the body in exactly the same manner as a compass is opened by means of a rack and quadrant device. Each of the arms is made with a telescoping bottom for adjustment to the various types of bodies. Loose collars with two projecting arms are slipped over the bottom of each arm to reach underneath the side of the body and support it at unpolished points. The looseness of the collars enables them to be turned in any direction or moved up or down to obtain the proper point of support.



Lifting an automobile body off its chassis by means of compass arms on a trolley



At left is a diagram of the lifting device

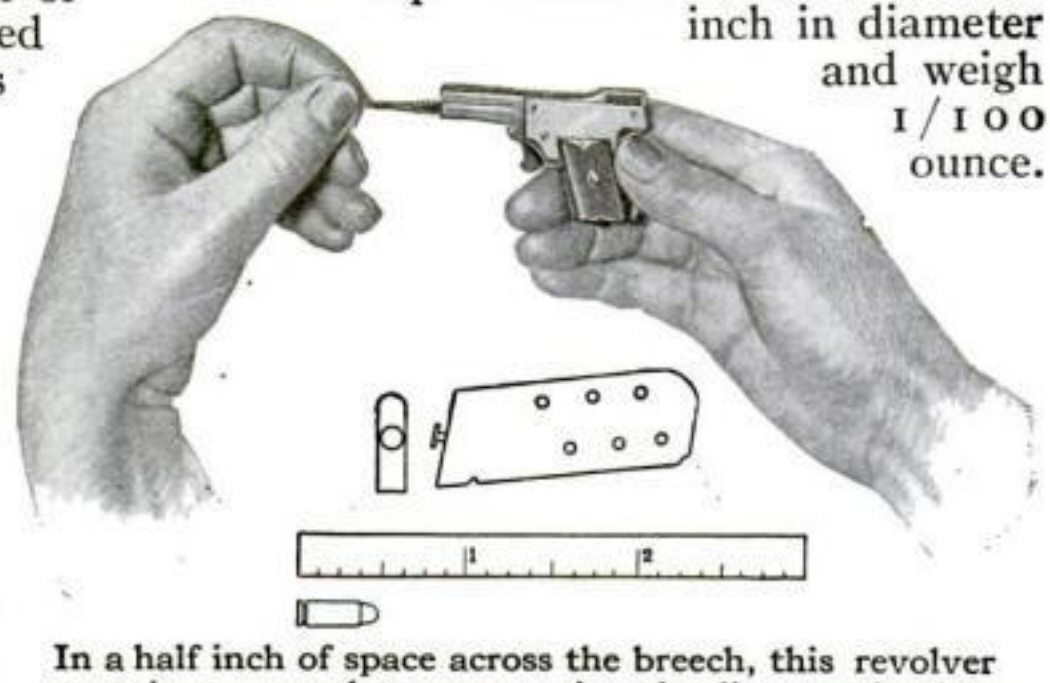
In operation, the framework carrying the lifting device is moved along its trolley so that the compass arms are on each side of the body to be lifted off the chassis. The arms are then spread out and the lifting collars adjusted and inserted under the body; after which the entire device is raised vertically by means of a chain block, until the body clears the projecting levers. It is then moved horizontally to its point of deposit. The reverse of this operation puts the body back on the chassis.

Sometimes the body must be lifted clear off the chassis frame for a height of two or three inches before the projecting arms on the lifting collars can be placed on some unpolished part. This may be accomplished by means of a two-part bar with beveled ends, which bar is held together at the center by means of a collar or sleeve. By removing the floor-boards of the car body, the beveled ends of the bar may be inserted between the bottom of the body sill and the frame.

An Automatic Revolver No Bigger Than Your Watch

AUTOMATIC revolvers are made about as big as a standard watch.

Little as these revolvers are, they nevertheless contain an automatic reloading mechanism as complete as that of any of their bigger brothers. They are "seven-shooters." Six cartridges are held in the magazines in the handle, and one in the firing chamber. The pressing of the trigger sends the firing-pin against a tiny percussion cap. The bullets are one-tenth inch in diameter and weigh 1/100 ounce.

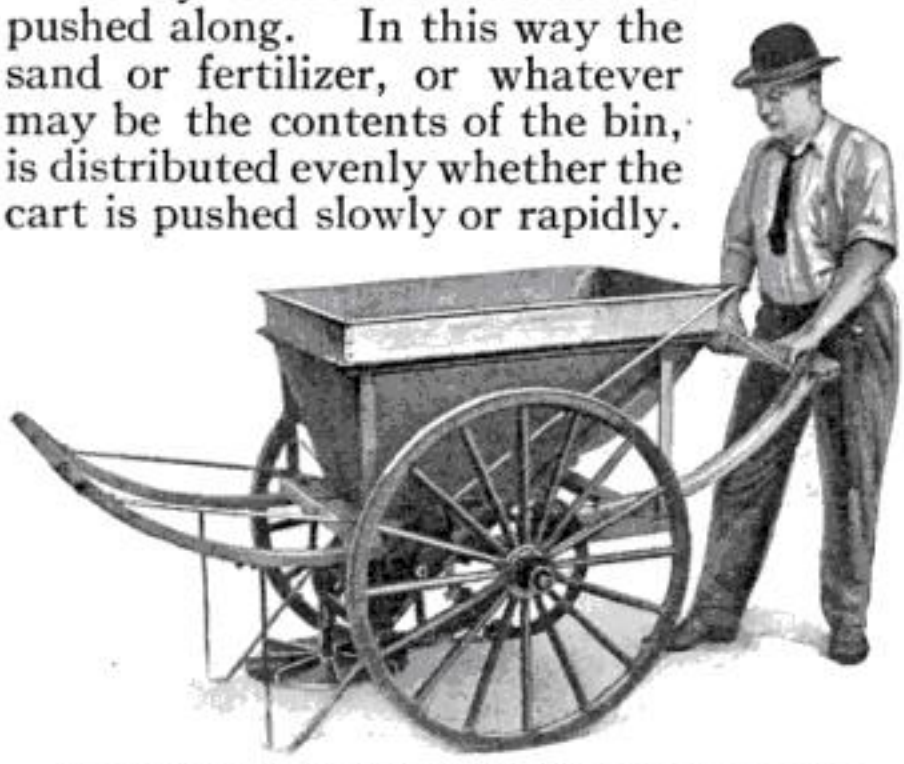


In a half inch of space across the breech, this revolver contains a complete automatic reloading mechanism

A Small Sand Spreader Is Useful All the Year Round

THE small two-wheeled bin device shown below is particularly adapted for spreading sand over small areas such as icy cross walks in the winter or over oily streets, or for scattering fertilizer in the summer. The sand is spread uniformly with no bare spots or large piles, hence this is preferable to the hand method. The device is also applicable to the spreading of ashes over country walks.

The apparatus consists of a funnel-shaped bin mounted on an axle with two wheels and provided with front and rear handles so that it may be pushed along from either end. A vertical rectangular opening is provided at the bottom of the bin with a slide-door through which the sand or other material to be spread drops upon a circular horizontal plate held in a vertical shaft on a frame attached to the axle. The circular plate is directly beneath the bin opening and is provided with curved radiating fins. The plate is revolved at a speed varying with that at which the cart is pushed by means of a set of bevel gears and a chain driven off a large sprocket on one of the wheels. The sand dropping on the plate is thrown off by centrifugal force when the plate automatically revolves as the cart is pushed along. In this way the sand or fertilizer, or whatever may be the contents of the bin, is distributed evenly whether the cart is pushed slowly or rapidly.

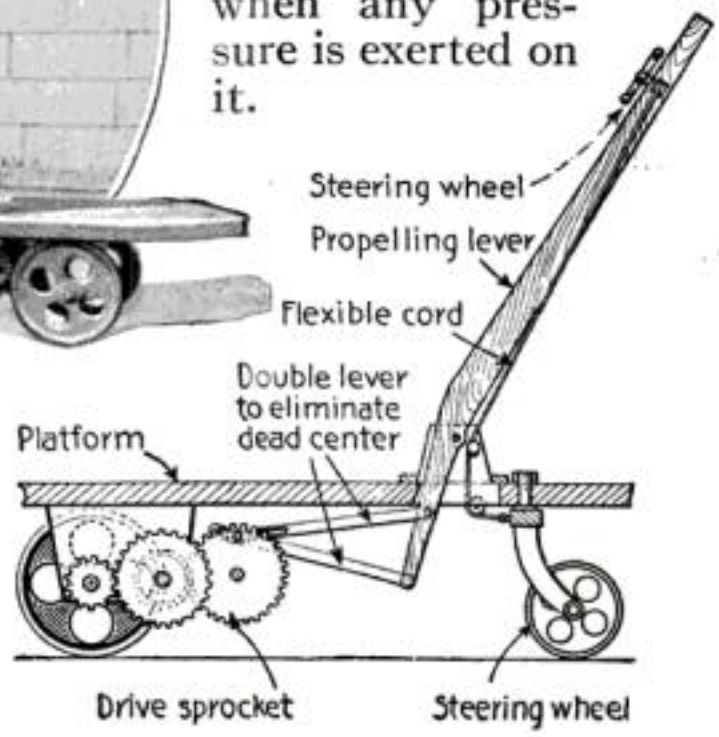


The funnel-shaped bin with its circular plate underneath, spreads the sand automatically

The Newest Child's "Pushmobile." It Is Built on a Novel Principle

A CHILD'S hand-propelled pushmobile has been invented by Charles R. van Horn of Aberdeen, Wash. The lower end of the operating lever is coupled by two connecting rods with the gearing that drives the rear wheels and propels the vehicle. The connecting rods are attached to the lever at different points; they also engage the first gear wheel at different portions. Hence, any dead center is eliminated. Whatever its position, the lever will immediately start the vehicle when any pressure is exerted on it.

A child can drive this ingenious vehicle with one hand. The diagram at the right explains the principle involved



A child can drive this machine with one hand. The steering is controlled by a rotatable handwheel mounted on the propelling lever. Two flexible cords connect this steering-wheel with opposite portions of a cross member attached to the mounting of the front wheel. The propelling lever is not tilted from side to side like a tongue but always moves in a straight forward-and-back direction lengthwise of the platform of the pushmobile. In fact, this steering wheel is operated like that of an automobile, so that the child in learning to drive the toy pushmobile is really trained to govern a big car.

For coasting, the gearing can be shifted out of operative connection with the propelling lever, the coasting device being regulated by the child's foot.

As an exerciser, this form of vehicle leaves nothing to be desired. Practically every muscle of the child's body is brought into action—notwithstanding the fact that the operation is smooth and easy. Naturally, the faster one wishes to go the more effort must be expended.

Washing the gold-containing gravel through a sifter which serves at other times as a hat

Panning for Gold in Central and South America

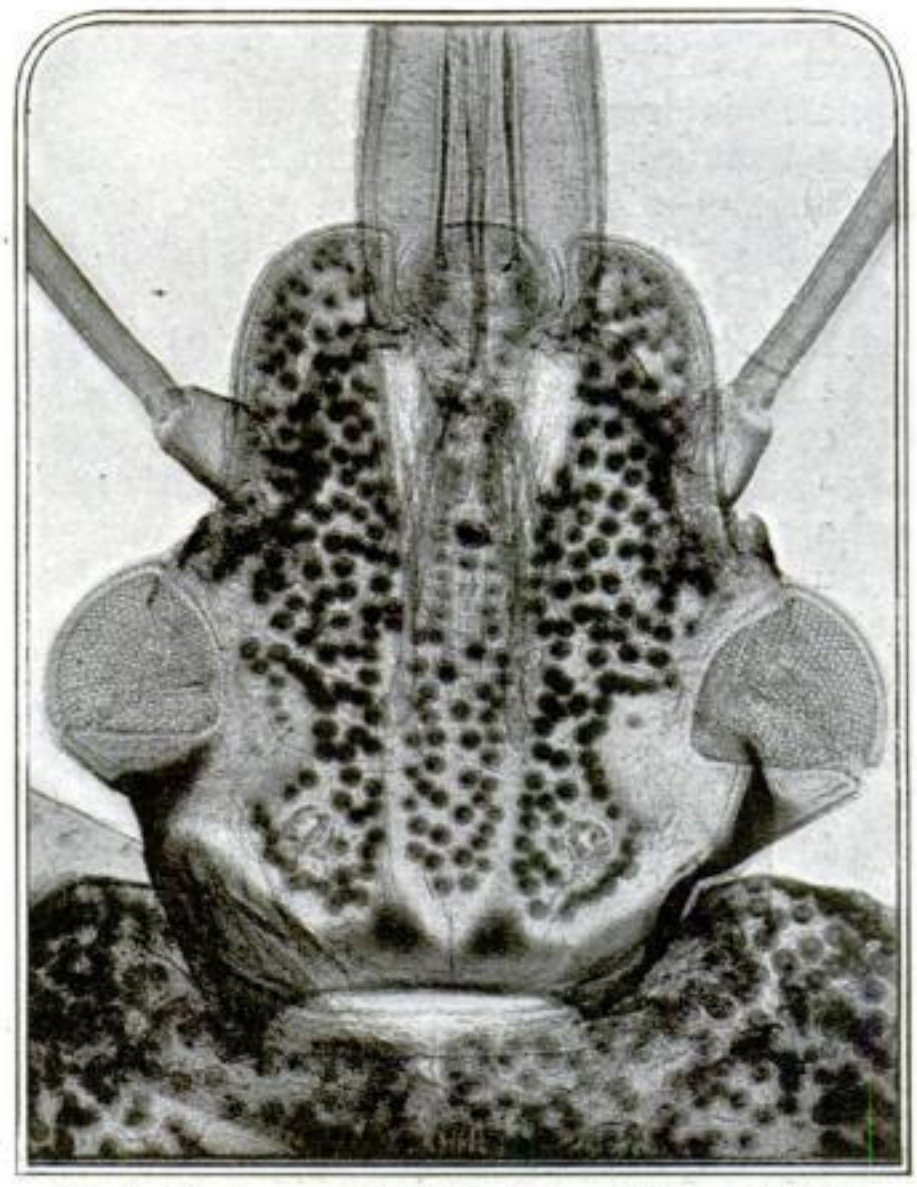
THE "battel" used by the prospector for gold in Central and South America in tropical placer mining is a better gold-saver than the Alaskan gold pan. Shaped like a platter, with a depressed center coming to a point in the middle, the gold collects in the point of this broad shallow cylinder. The pan is filled from a pool with gold-containing quartz gravel and is rocked in the orthodox manner. As the pan rests on the bottom the contents are tipped and swirled about until the dirt loosens and only the pure gravel and hard substances remain. Of these, only that which is bright yellow is valuable.

When the miner is not sifting gold with it he uses his battel as a hat.—GRACE S. MATHEWS.

Everybody Is Acquainted with the Squash Bug

SOME of us know all the bad things about the squash bug—that it is proverbially ill-favored and ill-smelling and an enemy to the squash vines. We have heard the entomologist speak about *Anasa tristis* with elaborate description of the bug that hibernates in the adult stage, wakes up in the early spring and lays its eggs on the young leaves of the squash and the pumpkin. We think of it as we think of a pest. From the human point of view it is a pest, but it improves on acquaintance. It is true to its family characteristics; it is really a bug; it is a member of the family *Heteroptera*, and is somewhat of a beauty (we mean the "lady-bug").

In the accompanying photograph the protruding part of the sheath is the tongue or sucking beak. The squash bug's eyes are large and beautiful, and really wonderful when seen under a microscope. The antennae or feelers, the two branched prongs between the eyes and the tongue, are marvelous organisms of sense. It would be difficult to enumerate all their duties, not because the list is long, but because we do not wholly know what those duties are. They surely enable the bug to recognize its surroundings; what else they do is beyond our understanding.



Portrait of a squash lady-bug. The protuberances at the side of the body are the eyes

But the most beautiful of all its anatomy is the curiously mottled sheath that covers the head and the thorax. These dots bear a high magnification, and the better one knows them the more does he admire them. It is indeed a marvelous object. It is astonishing that there should be so much beauty, so much elaborate structure where they seem misplaced so far as general human appreciation is concerned. —EDWARD F. BIGELOW.

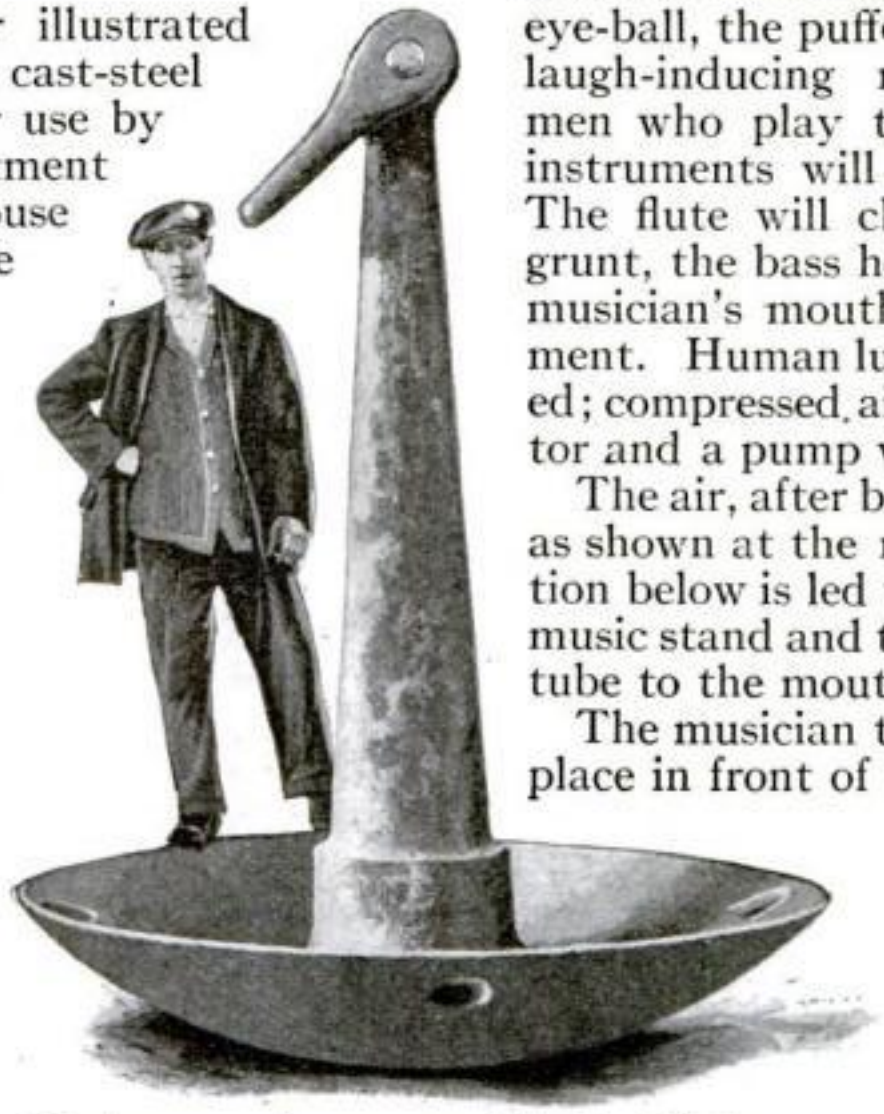
Giant Mushroom Anchors for Holding Buoys

"MUSHROOM" anchors take their name from their shape. They look like mushrooms upside down.

The mushroom anchor illustrated was made by a prominent cast-steel maker of this country for use by the United States Department of Commerce in lighthouse service for buoys. Those of this type weigh 5000 and 7000 pounds each and are made entirely of cast steel except the shackle pin. They are practically one piece. The buoys are attached to these. The anchor holds the buoy in the location desired.

The test to which these anchors are subjected before acceptance by the Government is extremely severe. Each anchor is dropped on a steel block from a height of twenty-five feet.

Should a fracture of any kind appear as a result of this test the anchor is rejected. Formerly these anchors were made of cast iron but the Government's requirements now demand steel because of the severe treatment to which they are subjected in rough weather.



Mushroom anchors are used in the lighthouse service to hold buoys in place. They contain from 5000 to 7000 pounds of steel each

The Rate at Which Food Prices Have Advanced

HOW much has the cost of food advanced? According to one of the leading statistical houses of America, cabbage has gone up 850 per cent since last year; onions, 1,100 per cent; potatoes, 280 per cent; eggs, 77 per cent; beef, 20 per cent; pork, 70 per cent; butter, 30 per cent; wheat and flour, 46 per cent; beans, 90 per cent.

The Compressed-Air Orchestra: Human Lungs Give Place to Tanks

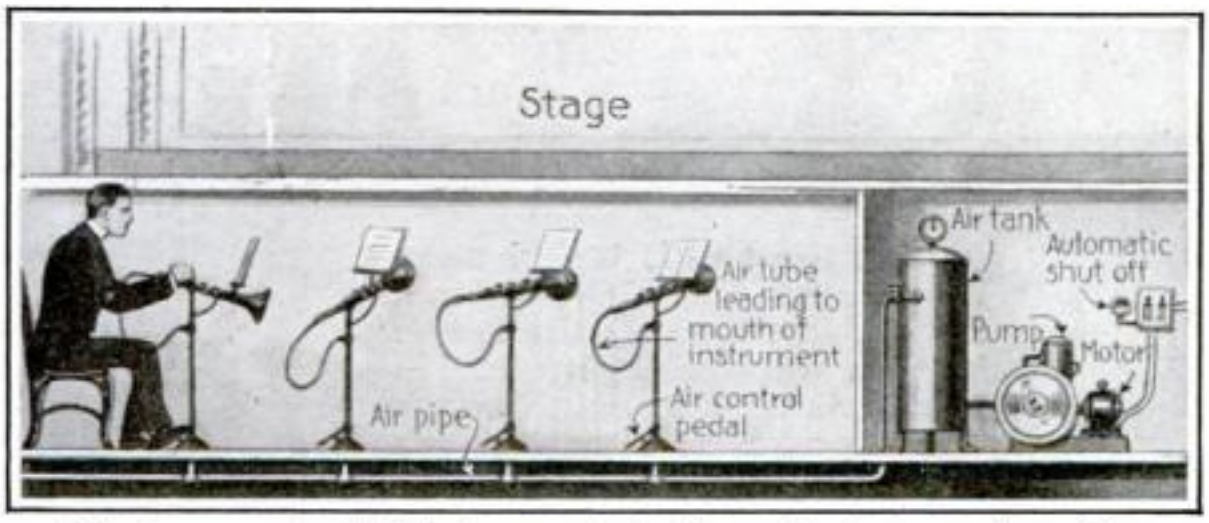
IF the inventors have their way, musicians will no longer need to blow their souls into their instruments. The inflated eye-ball, the puffed cheek, and all the laugh-inducing mannerisms of the men who play the wood and brass instruments will become as history. The flute will chirp, the saxophone grunt, the bass horn growl, without a musician's mouth at a single instrument. Human lungs will not be needed; compressed air furnished by a motor and a pump will take their place.

The air, after being stored in a tank, as shown at the right of the illustration below is led through a pipe to the music stand and thence through an air tube to the mouth of the instrument.

The musician takes his accustomed place in front of his instrument, with his foot on the air-control pedal at the bottom of the stand. He plays with his hands and one foot. The air-control pedal works like the accelerator of an automobile engine; it enables the musician to accurately regulate the supply of air at all times.

The inventor does not make any provision for tone shadings. Although he can regulate the supply of air he can not give delicate gradations of expression. Consequently, music from instruments played by compressed air will be more or less mechanical. Moreover some brass and wood instruments must be played by living men, because the notes are formed by the lips. But for certain well-defined purposes and in places where the audiences are not over-critical the compressed-air orchestra will probably prove as popular as the mechanically operated piano.

In this way one musician can operate several instruments.



The brass and wind instruments in the orchestra are played by compressed air instead of lung power and operated by one man

Five Tools in One

Here is a combined spade, knife, pick-axe, hammer and trench weapon

A TOOL which permits of a wide variety of uses has been invented by Dr. F. P. Archer, of Wilkes-Barre, Pa., and could with advantage take its place beside the other necessary equipment of the fighting man. A modern army must not only be equipped, each man individually, with practically every necessity for fighting and for health and comfort that space will permit, but it must be equipped with tools to dig itself into the ground when necessary.

The tool invented by Dr. Archer may be used as a spade, a knife, a pick-axe, a hammer and a weapon for hand-to-hand fighting or trench raiding. The blade of the spade is carried in a pocket across the breast, as shown. Carried in this position it is a shield protecting more than twenty-five per cent of the vital anatomy of the wearer while facing an enemy bayonet charge. On the other hand, it is made of chrome nickel steel so tempered that it will resist a service rifle bullet at two hundred yards and will be ample protection from a forty-five caliber revolver bullet at close range.

Here the combination tool-weapon-shield is a peaceful-looking hammer-headed spade

The entire outfit, including the pocket, weighs only four and one half pounds. The spade shield is the heaviest part of the equipment. The spade blade can be attached to the handle of the tool without screws or bolts or small parts.

At left the tool is tucked away in its pocket where it serves as a shield. In the center the handle is in use with the hammer head in place. At right is shown how the spade is adjusted without screws or bolts by sliding it on the rod

Coaxing Music from a Pile of Rocks

A MR. FROST, of Marblehead, Mass., was engaged in clearing his land of some huge, flat rocks, when he accidentally struck one with his hammer. It emitted a clear musical note. He struck another in the same way. The tone given out was equally clear and sweet but different in pitch. Trials with other stones of different shapes and sizes convinced him that it was possible to arrange the stones so as to get the notes of the scale.

After various experiments he piled the stones as shown in the accompanying photograph, securing thus a primitive instrument that any cave-man might have envied.

The "piano" made of a heap of stones arranged so that the tones of the natural scale are produced by hammer-blows

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Household Bookless Bookkeeping on the Poker-Chip Principle

A NEW system of bookless bookkeeping, designed especially for the housewife, happily coincides with the demand for careful record keeping in order to cut down expenditures to a wartime basis. This new system substitutes for old fashioned juggling with figures the simplicity and vividness of account-keeping with poker chips.

With the new method, books are entirely eliminated. The equipment consists of a box containing twenty-eight compartments to show expenditures for groceries, meats, milk, butter, eggs, and other items of household expense, and seven additional compartments to hold slips representing various denominations from ten dollars down.

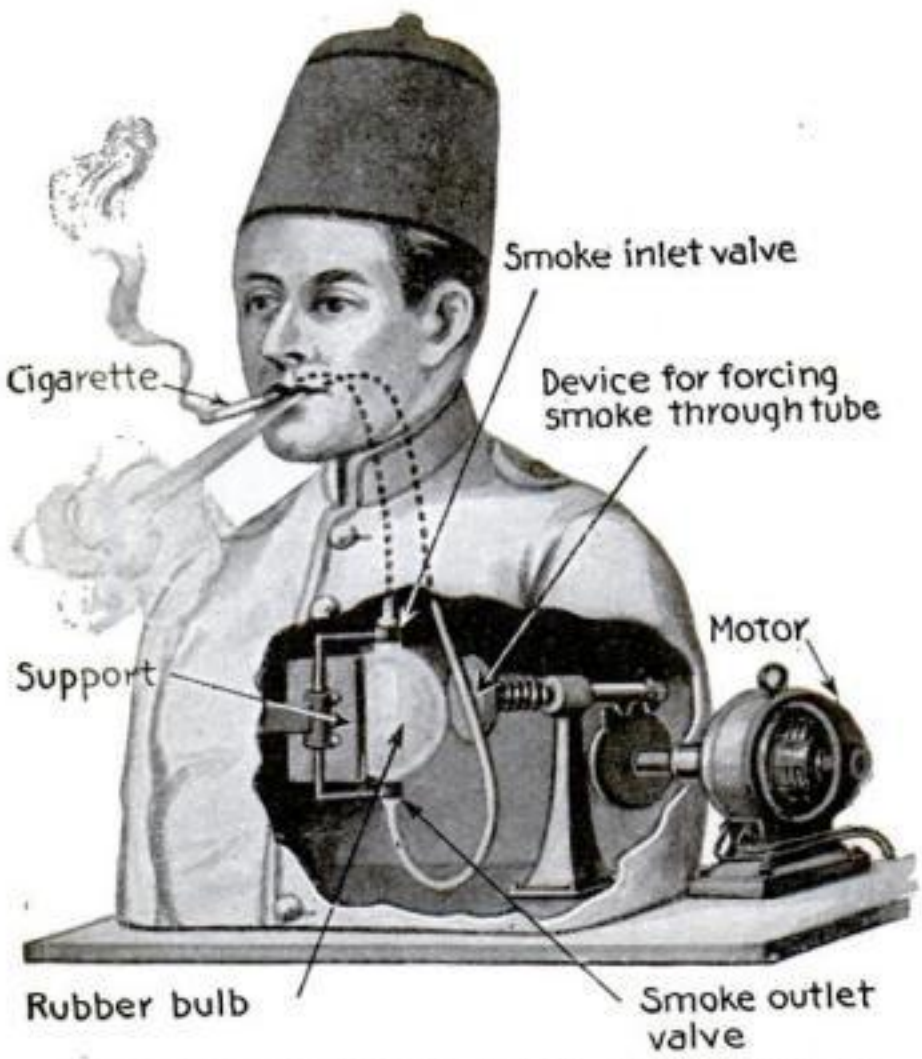
When a purchase is made, slips indicating the amount are placed in the appropriate compartment. At the end of the month, the housewife can determine the amount spent for each item by counting the amounts in the different compartments.

If the article is charged, the right amount is placed in the proper compartment, and a corresponding amount in the "Charged" compartment. Thus there is a correct tab on the amount owed as well as on the expenditures.

After the housewife has determined by a two or three months' trial about what her normal expenses are for the various items of expenditure, she may change to the budget system. Slips totaling the proper amount are placed in the various compartments, and, as expenditures are made, the amount is removed. The slips remaining show at all times the sum left in each "appropriation," so that economy or freedom in spending may be observed. If the slips in any compartment run short, others may be "borrowed" from a compartment with a surplus, a "due" check being put in to show the indebtedness.

The amounts remaining at the end of the month indicate the surplus, and the due checks shortages. Thus all figuring is eliminated.

The bookless bookkeeping outfit for the housewife who dislikes keeping accounts



The dummy smokes a real cigarette in a realistic manner. Smoke is drawn in through one tube and is forced out through another

The Dumb Turk. He Smokes Cigarettes and Doesn't Know It

A DUMMY who smokes cigarettes as realistically as a living human being is now used to advertise the fragrant aromas of different grades of tobacco. The idea is not to show the public how well a cigarette burns or how well the dummy smokes it, but to enable smokers to smell the smoke as it is automatically puffed out by the apparatus concealed within the dummy. The moment cigarette smoke is drawn into the mouth it loses its odor. With the dummy none of the fragrance is lost.

There are two tubes within the dummy. One leads to the cigarette in the dummy's mouth and thence to a bulb. A second tube extends from the bulb to the mouth. The smoke is drawn in through the first tube and through a valve into the bulb. When the bulb is pressed the smoke is forced into the second tube and led to the mouth, where it is expelled. A small motor operates the bulb. It is regulated so that the dummy can smoke fast or slow as the exhibitor desires.

An Easily Adjusted Tire. It Locks Itself on the Wheel

A NEW type of tire just brought out by an Akron manufacturer is designed to eliminate the trouble experienced in mounting either a demountable or pressed-on solid tire on the wheel of a motor-truck. It employs the compression of an annular rubber pad between the steel base of the tire and the steel felloe band on the wheel to lock the tire on the wheel. The annular ring or pad of rubber is about one inch thick and is the same width as the tire proper. This rubber pad is inserted between the steel base of the tire and the steel felloe band on the wheel. The pad is retained by two steel rings, one on either side, bolts extending clear through the pad from one ring to the other. Twelve of these bolts are employed, each with a nut on the outside of the wheel. As these bolts are screwed down by means of a socket wrench, the width of the rubber pad is decreased while its thickness is increased.

This swelling of the pad exerts pressure on both the base of the tire and on the steel felloe band, serving to lock them together and make them revolve as a unit. The tire is removed in a few seconds time by merely loosening up the twelve bolts and permitting the pad to assume its natural thickness. Then the tire is simply slid off the wheel.

Aside from the characteristic of easy attachment and removal, the pad also serves as a cushion to the tire itself, tending to reduce the road vibration transmitted to the wheel, axle and driving mechanism. Other claimed advantages for the pad are that it permits greater truck speed without harmful effect, greater tire mileage and ability to wear the tires down nearer the base, all because of the greater resilience of the wheel as a whole due to the increased amount of rubber between the axle and the point of contact with the ground.

In application, tires of the next larger size or two inches greater in diameter are employed. In this way wheels of the same size as those on which the ordinary tires are pressed may be used. The pad also prevents the surfaces from rusting together.

The annular rubber pad compressed between the base of the tire and the steel felloe band locks the tire in place

Closing Up a Wound Without Using a Surgeon's Needle

A NEW method of drawing together the parts of a wound so as to give Nature a chance to knit them permanently together again, eliminates the surgeon's needle, together with the pain of the sewing-up process. In this new method a lacing plaster is used, a strip on each side of the wound. After the wound has been cleaned and dressed, the plaster is applied, one strip on each side of the cut, with the edges of the plaster about one-quarter of an inch from the edges of the wound.

Lacing the plaster over a wound. The edges of the cut are gently drawn together and held in place until healed

Loops of thread, like a scalloped edging, are provided in the plaster to receive the lacing, which is stiffened and used without a needle. The ends of these scallops are woven into the material so that they will not pull out. When the thread has been looped through opposite scallops in the sections of the plaster, the loops are drawn up, thus gently closing up the gap in the torn flesh. The wound is left exposed to the air through the threads, so that it may be drained and examined occasionally without disturbing the arrangement of the plaster.

If a dressing of gauze is used, it may be changed when desired without removing the plaster. The threads are clipped and removed, leaving the wound exposed for the treatment. Afterwards the plaster is laced again with fresh thread. One application of the plaster strips is usually sufficient for the entire period of healing.

The "Pretty Maids" of a Chinese Window Garden

"MARY, Mary, quite contrary, how does your garden grow?"
"With tinkle bells and conchal shells and pretty maids all in a row."

So goes the English nursery rhyme, but it remained for the Chinese to make a practical application of the idea. The two photographs below show how the pretty maids are made to grow in the miniature flower gardens of China. But any little American girl may do the same thing with the head and arms of an old discarded doll.

First an ordinary flower pot is filled with soil. Into the center of this is thrust a stick about ten or twelve inches long. To this other sticks are tied (arranged as shown at left in the illustration) in order to give breadth to the lady's skirt when she is dressed in her verdant costume. The head of the doll should be fitted securely on these sticks, and the arms should be fastened with twine or wire.

How the "pretty maids" of a Chinese garden grow their verdant costumes

Plant in the soil a few seeds of dwarf nasturtium, morning glory or any small creeper and keep them well watered. As the plants grow up, train the shoots on the framework of the doll and pinch them off as soon as they reach the neck in order to cause a thicker growth at the sides. Soon the entire frame will be covered, and the lady will be gorgeously attired. But in order to keep her looking her very best continually, it will be necessary to keep the vines closely cropped. Ornamentation is provided by the blossoms.

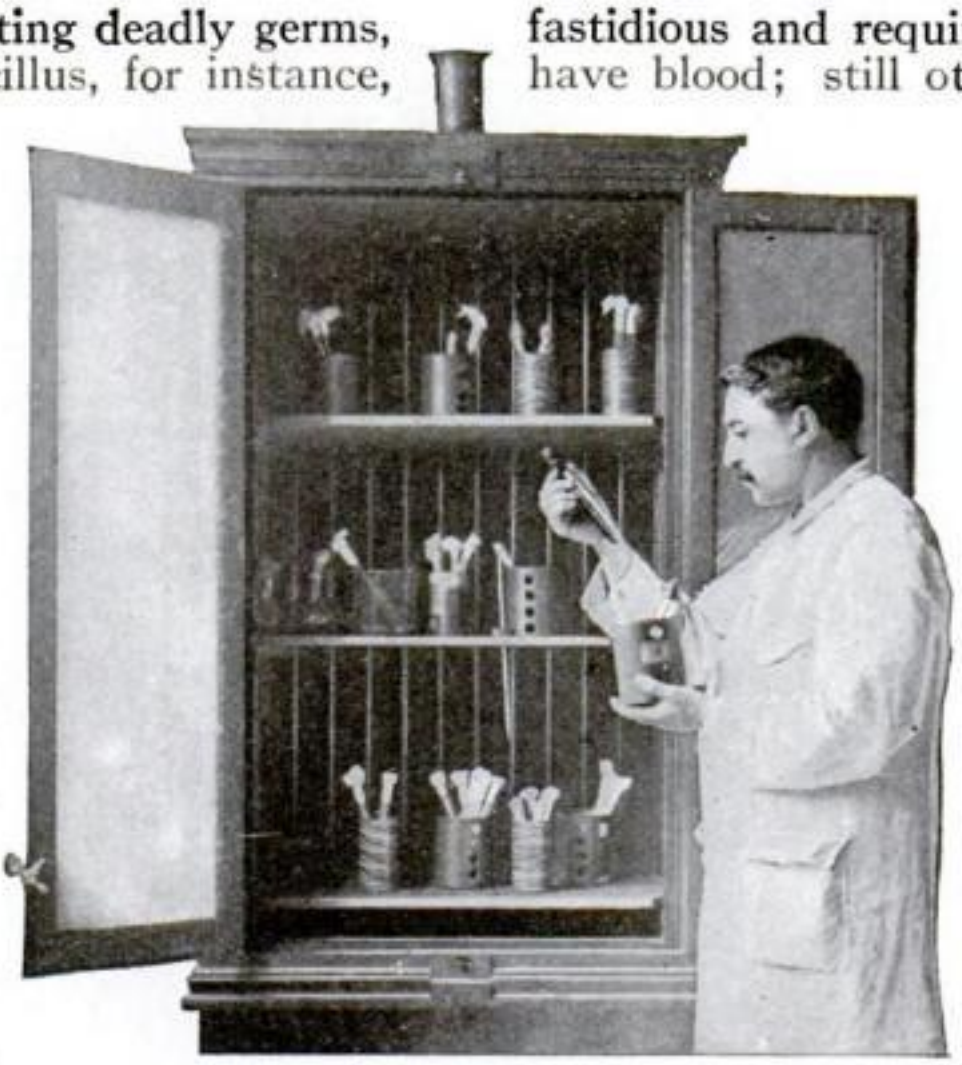
Mollycoddling the Microbe

Some of the deadliest germs are very delicate and require plenty of milk and eggs

THINK of cultivating deadly germs, the typhoid bacillus, for instance, with as much care and attention to diet and environment as would be given to a delicate orchid or even to a beautiful baby! That is what is being done at the American Museum of Natural History in New York city.

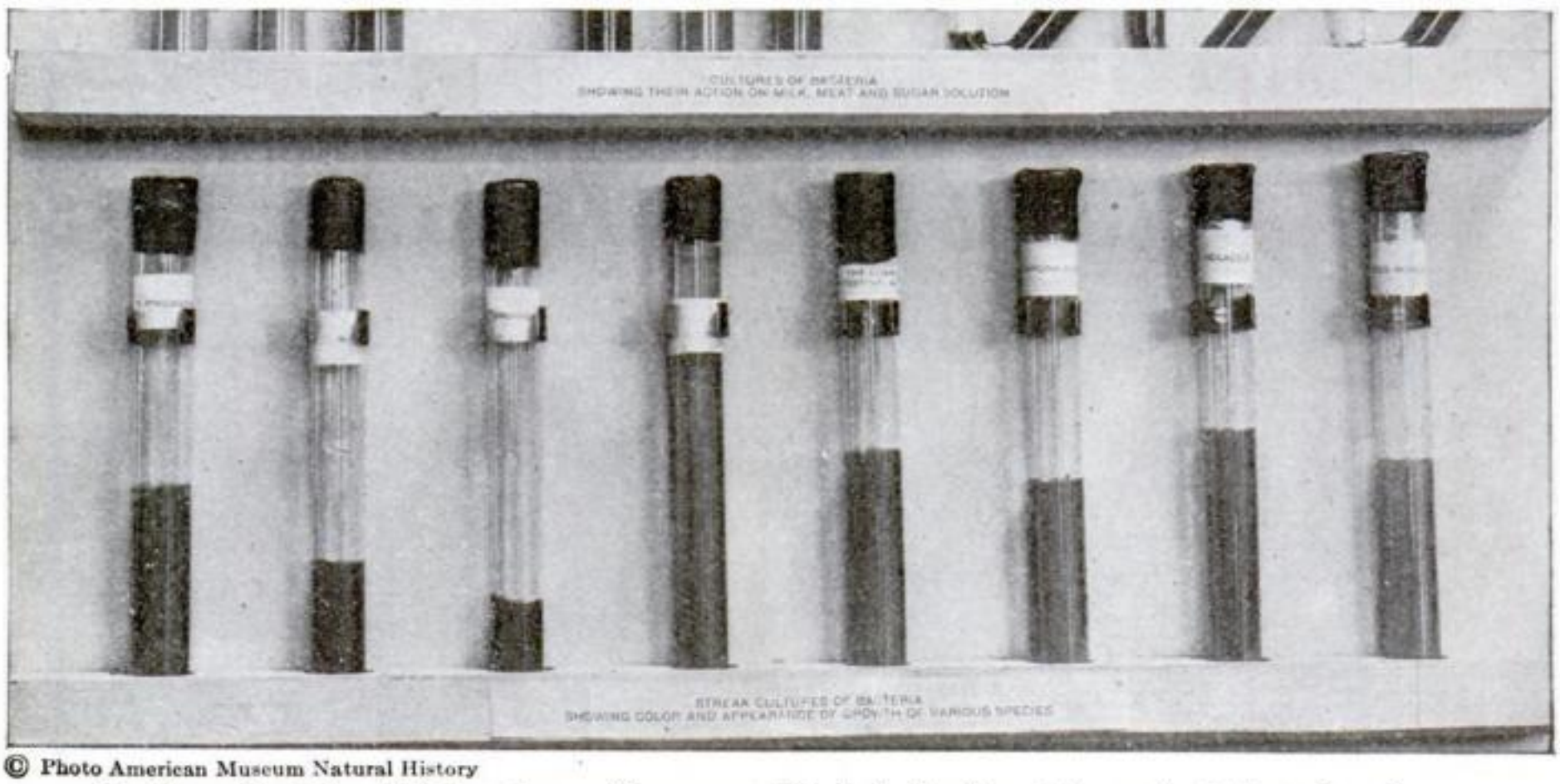
Up in one of the tower rooms there is a regular nursery for germs. They live in tubes, rows on rows of them, in neatly arranged and classified wooden racks. Each tube contains a jelly, and on top of this jelly is a wrinkled mass of whitish, yellowish or brownish scum. In this scum are the babies—or plants, as the Museum bacteriologist classifies them.

The jelly is made up of meat, peptone, and the extract from agar, a Japanese seaweed. Some of the germs, however, are fastidious and require egg; others must have blood; still others need milk and special kinds of salts. The food preferences of each particular germ are as carefully studied and compounded as are the special dishes in the diet kitchen of a hospital.



Needless to say, the germ-filled tubes are handled with extreme caution by the examiners

Some of the bacteria will live for weeks without special attention, while others must be transferred to a fresh tube of food jelly every three days. To transfer them, the bacteriologist in charge simply touches the scum in the tube with a platinum needle. The bacteria adhere to the needle but readily drop off into the fresh jelly. The fact that 400,000,000 of the typhoid bacilli could be packed into a grain of granulated sugar will give some idea of the size of the microbes.



In the yellowish, whitish or brownish scum which is to be found in each of the tubes there are millions of infinitesimal microbes feasting and flourishing on the food jelly of their choice

Put Your Flowers Outdoors on This Adjustable Window Shelf

WITH a new adjustable window-shelf invented by Earle H. Bartlett, of Kansas City, Missouri, flower pots can be placed outside the windows with perfect safety, provided city ordinances allow it.

The shelf permits the window sash to be raised or lowered. Besides, it can be attached to ledges or stools of various sizes, a bracket support compensating for different widths and maintaining the shelf in the proper horizontal position. The shelf is fastened to the window ledge by screws and a metal strip so that the window-sash can be raised without striking it. To support the front portion of the shelf there is a brace or bracket with a wing-bolt and slot connection, as the illustration shows. This arrangement allows the shelf to be adjusted up or down to fit the different widths of ledges, a plate on the bottom of the shelf being rigidly secured when the wing-bolt is turned.

An adjustable window shelf which can fit any ledge and be kept in the proper horizontal position

Figures That Give an Idea of the Task of Transporting Our Armies

SOME idea of the enormity of the task of moving the great bodies of United States troops to be raised may be gained from the following figures: 6,229 cars are necessary to transport an army of 80,000 men. These cars would be made up into 366 trains with as many locomotives. There would have to be 2,115 passenger coaches, 385 baggage, 1,055 box, 1,899 stock and 775 flat cars.

This quantity of equipment represents seven-tenths per cent of the locomotives owned by American railroads, 4.2 per cent of their passenger cars and two-tenths per cent of their full equipment.

A field army consists of three infantry divisions, one cavalry division and a brigade technically known as a brigade of field army troops—troops auxiliary to the infantry and cavalry divisions.

Railroad equipment required to move various organizations of the army at war strength is as follows: Infantry regiment—55 officers, 1,896 men, 177 animals, 22 vehicles—total of 85 cars. Cavalry regiment—54 officers, 1,284 men, 1,436 animals, 26 vehicles; 150 cars. Artillery regiment—light—45 officers, 1,170 men, 1,157 animals, 32 vehicles, 24 guns; 170 cars. Artillery regiment, horse—45 officers, 1,173 men, 1,571 animals, 35 vehicles, 24 guns; 194 cars. Artillery regiment, mountain—45 officers, 1,150 men, 1,229 animals, 24 guns; 124 cars. Engineers, pioneer battalion—16 officers, 502 men, 165 animals, 12 vehicles; 38 cars. Signal corps, field battalion—9 officers, 171 men, 206 animals, 15 vehicles; 28 cars.

Can you tell at a glance what is wrong with this soldier?

A Sculptor's Error in a Famous Military Group

WHENEVER there is a military parade in Washington, D. C., and the soldiers or others who have had military experience are in the vicinity of the magnificent statue of General Sherman, which stands just south of the Treasury, there is sure to be comment on the blunder which the sculptor made in connection with the equipment of the figures at the base of the statue. The blanket roll, which is properly carried over the left shoulder by soldiers, is here shown over the right shoulder, where, as even the small boys know nowadays, it would interfere with the gun.

Delivering Ice Cream by Motor-Truck

The truck is fed ice and salt in much the same way that a locomotive is fed coal

A NEW type of body fitted on a motor-truck is designed to save time in the delivery of ice cream at retail. It has separate compartments for the ice cream in cans, for the mixing ice and for the salt.

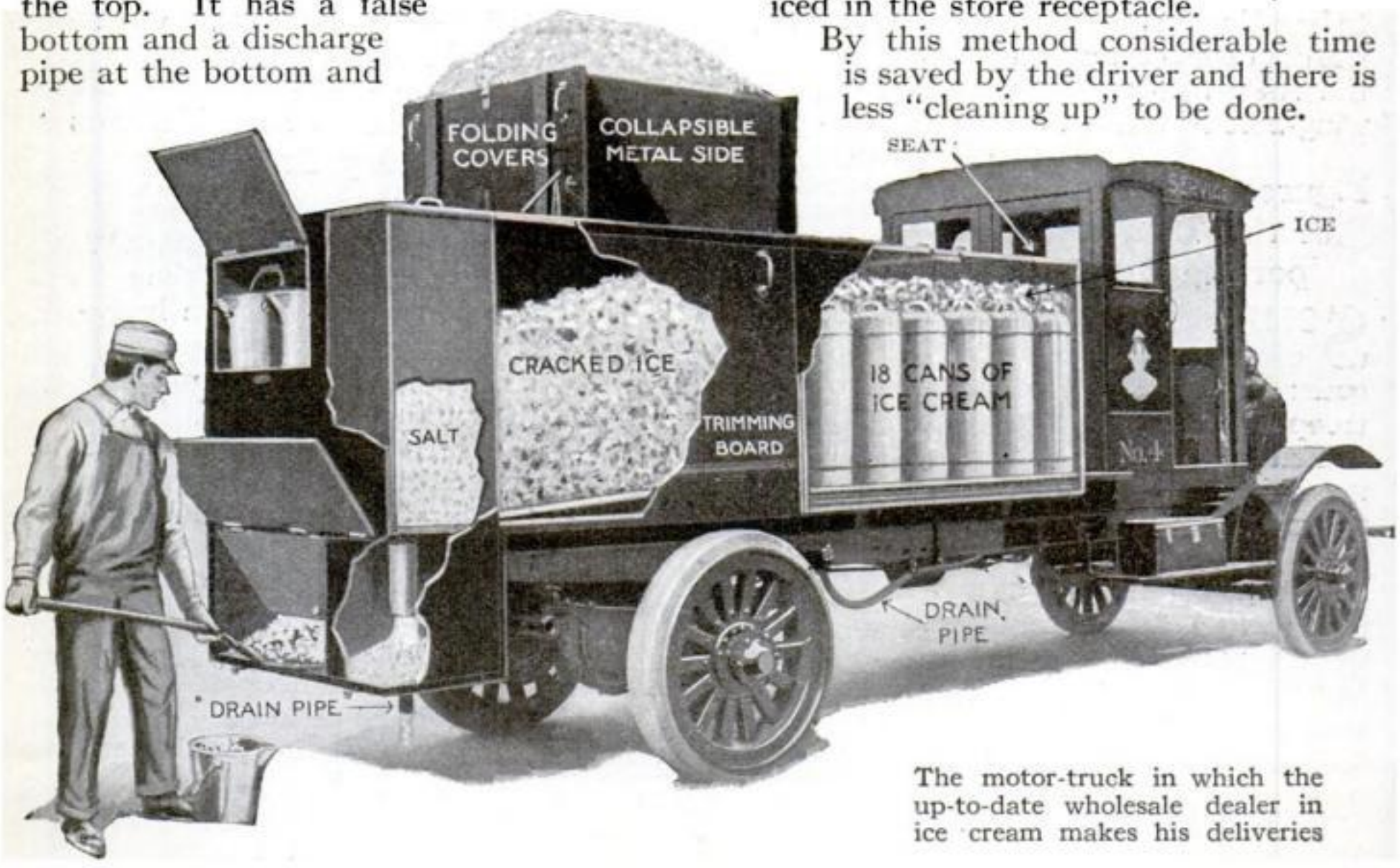
The compartment nearest the driver's seat is used to carry eighteen of the conventional ice cream cans packed in ice and salt in the usual manner. The ice compartment, of the same width and about the same length as that in which the cans are carried, is extended down at the rear to a point about one foot from the ground. It has a sloping false bottom which permits the ice carried therein to move to the bottom of the rear end by gravity while the truck is in motion, where an adjustable slide is provided to regulate the amount working to the rear. A hinged door is provided at the bottom of the rear end through which the ice may be taken out by means of a shovel.

At the right rear side of the ice compartment there is another smaller one extending to the top and slightly less than half the width. Into this the salt is poured through an opening in the top. It has a false bottom and a discharge pipe at the bottom and a door at the rear by which the salt can be taken out.

Both the ice cream compartment and that for the cracked ice have folding covers, those on the latter being arranged to be swung up to a vertical position and used in conjunction with removable metal sides to form a box in which additional ice can be carried on hot days or long routes. Both compartments are cork insulated. Another small compartment at the rear of that for the ice is used to carry the pails in which the mixed ice and salt are carried to the cabinet or other receptacle in which the retailer keeps his ice cream. Running boards are provided on each side of the body.

In operation, when the vehicle arrives at a point of delivery, the driver takes out the filled cans while standing on the running board, leaving them on the running board for convenience. He then goes to the rear, takes out one of the mixing pails and scoops into it the desired amount of ice and salt while standing on the ground. He then carries both the filled cans and the mixed ice and salt into the store of the retailer where the cans are iced in the store receptacle.

By this method considerable time is saved by the driver and there is less "cleaning up" to be done.



The motor-truck in which the up-to-date wholesale dealer in ice cream makes his deliveries

Holding the Whetstone Where It Is Needed

FOR unnumbered ages—perhaps ever since knives were invented—women and housemaids have sharpened those used in the kitchen on the edges of stone crocks or on the sandstone slab under the kitchen range, simply because the whetstone or corrugated steel for the purpose was not at hand at the moment when it was needed.

Now Arthur L. Walker, of Hoopeston, Ill., comes forward with a little contrivance which can be fastened to the wall or to any upright, at a convenient angle so that it will always hold the whetstone in the correct position for use and in the most accessible spot.

The whetstone is held at a convenient angle and height in a frame nailed to the kitchen wall

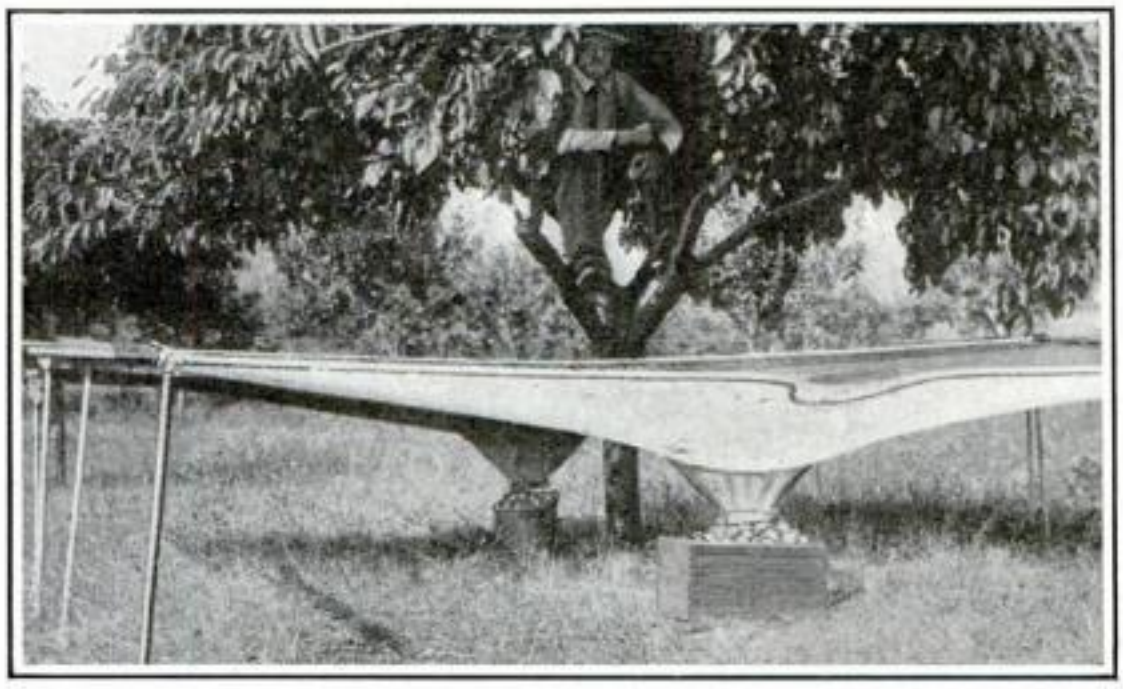
The devise consists merely of a piece of sheet metal so shaped that the whetstone fits into it securely and is held in place by the up-curved ends. The outer edges of the upper end are flattened out as shown in the illustration to receive screws which fasten it to the wall.

What's the Matter with American Feet and Legs?

AMERICA'S physical foundation—the feet and legs of her citizens—is unsound, if we are to believe P. A. Vaile, who has made a study of feet. If we do not discard the present monstrosities in footgear and get into the habit of walking, using our legs and feet instead of the automobile and street car, he says we will become human penguins. He calls attention to the fact that Dr. Lloyd Brown, the examining physician of Harvard, found that 596 of 746 members of the 1916 freshman class stood in a manner that indicated "a potentiality for sickness," and that 476 of the 596 students had feet and legs so imperfect that they were ineligible for military duty! Lack of leg exercise is supposed to be the cause of this condition. Mr. Vaile says that the American woman has neglected herself for so long that her legs and feet are suffering malformations. There is no longer in her leg the beauty of the classic line. We dare not contradict Mr. Vaile on this phase of the subject. It may be that the specimens seen on the beaches and 'neath the modish skirts of the season are not what he calls representative.

The Stationary Fruit Net—The Fruit-Picker's Dream Come True

AN ingenious method of gathering fruit which reduces the fruit-picker's work to a minimum, makes use of a large net suspended above the ground directly under a tree and does away with the usual fruit-picking harness, buckets, pails and baskets. The fruit is dropped from the tree by the picker and it falls into the net and rolls down through a cone-shaped canvas spout into a barrel or fruit box. The net is held taut by a framework supported by iron posts driven in the ground. In addition to giving the picker the free use of both arms, the suspended net catches all fruit which may fall overnight or which may be shaken down by the wind. Furthermore, the only time the picker need come to the ground is when the fruit box is full.



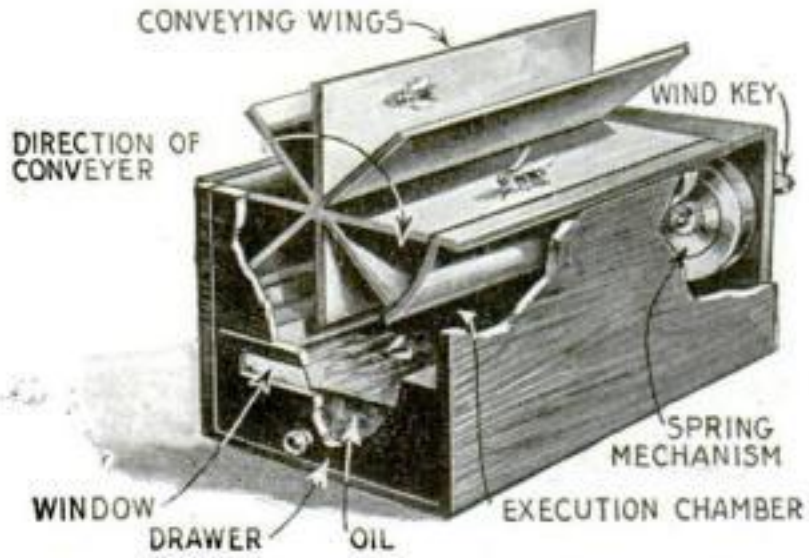
The picker plucks the fruit and lets it drop. It hits the net and rolls down through a spout into a barrel or basket

The "Swat the Fly" Campaign Is On. Here Is a New Trick

WHILE the "swatter" has done its bit toward final victory over the fly, it has its disagreeable features. Strips of sticky fly-paper and similar devices are unsightly and disagreeable also. The invention of Crystal Hilgers of Chicago, Ill., eliminates the unsightly elements of the fly-warfare.

The invention is a small box-like contrivance with extending wings connected with a slowly rotating shaft which leads into the box and down into a channel filled with kerosene. The wings are coated with molasses. The shaft rotates so slowly that the flies attracted by the molasses are not shaken off. When they are inside, the kerosene fumes in the channel affect them, and they drop down into the container in the channel, which may be drawn out from the side and emptied occasionally.

The captured flies are at no time visible except when the container is emptied.



The flies are lured into the chamber by molasses on the slowly revolving shaft wings, and are dropped off into kerosene

Going to College to Learn Wood Graining

A NEW sort of school, designed solely to benefit the man who cannot afford to leave his home to acquire a broader knowledge of his profession, has been established in Iowa by the State College at Ames. It is a short course for the painter and decorator whose education and training in his profession has been of the "pick-up" variety.

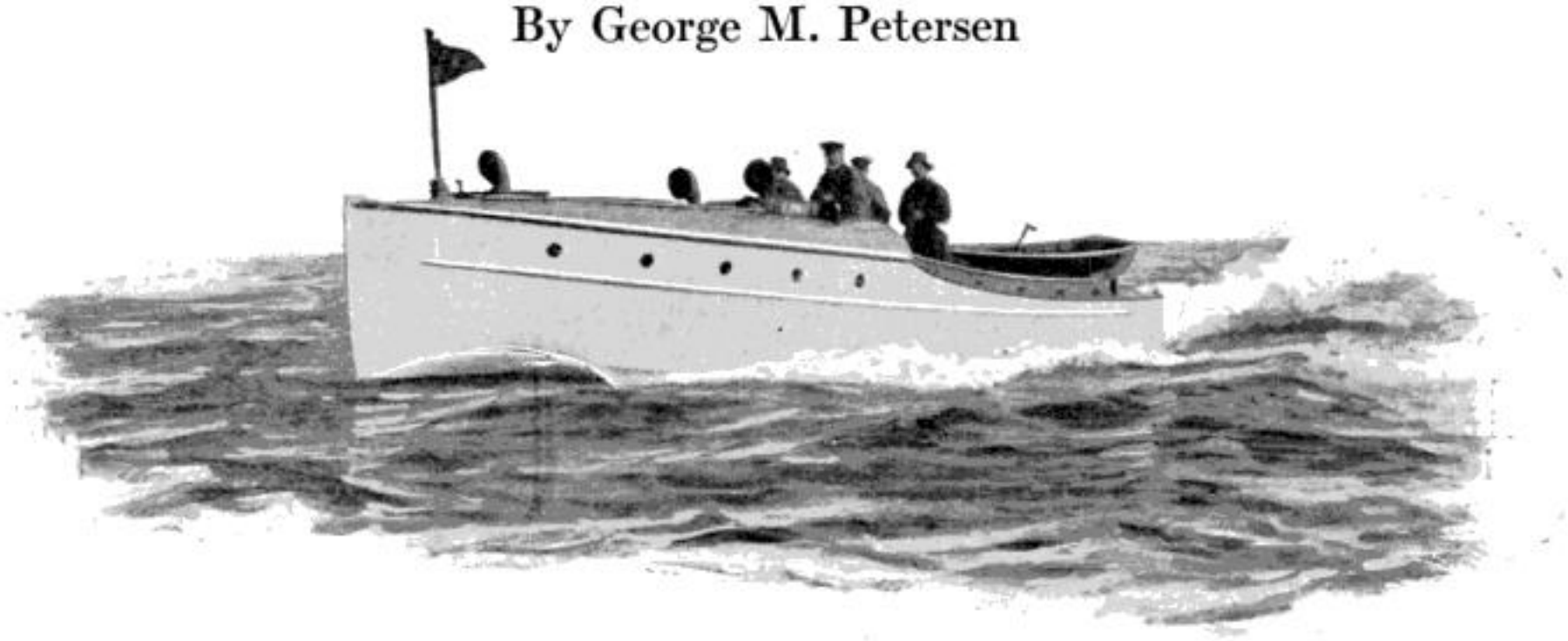
Each year painters and decorators from over the state gather at the college to spend four weeks in more detailed study of the scientific principles of painting and decorating. Two additional short courses are conducted under the direction of the college. These courses last one week, and are usually held in the different cities as the result of some arrangement with the local commercial club or some other public organization. In the evening sessions there are lectures and discussions of individual problems. This is believed to be the first school of its kind.

Pupils of the Iowa State College Traveling School studying the best ways to grain wood. Every student is under the supervision of an expert instructor in the art

Practical Motor-Boating

II.—The proper location of the power plant and mechanical attachments, and their care and operation

By George M. Petersen

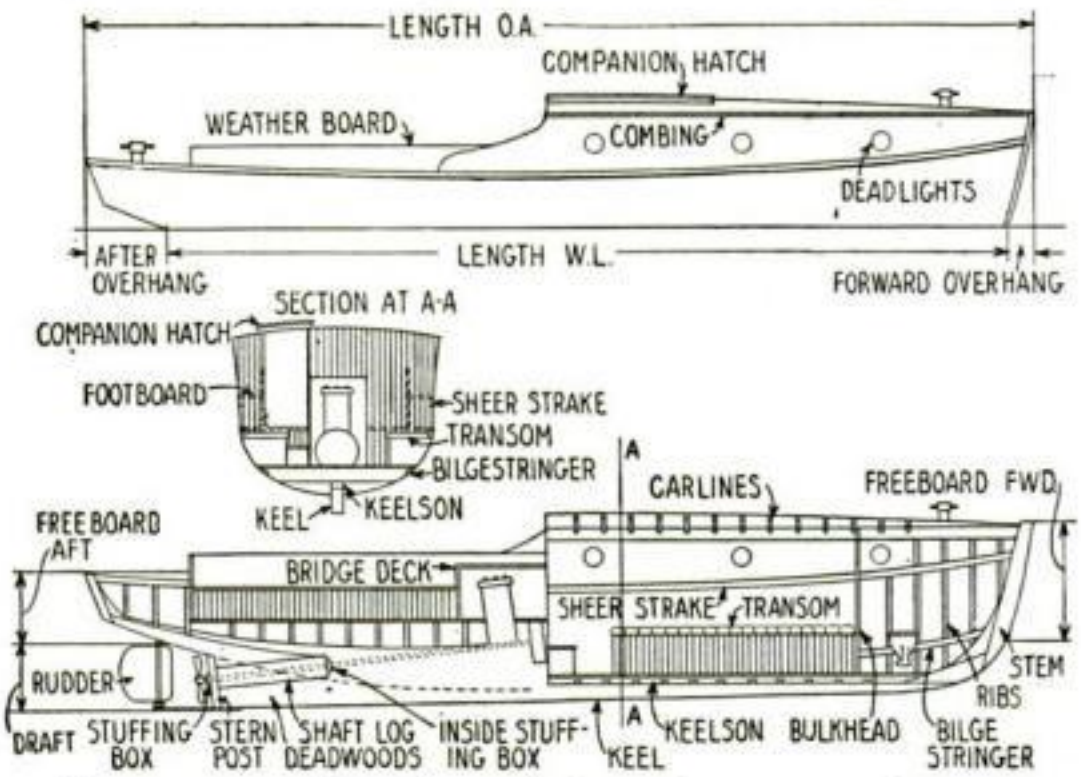


THE amateur boatman should thoroughly understand the names and location of the various parts of his craft, in order to take good care of it. The principal ones are as follows: stem, keel, stern-post, deadwood, shaft-log, keelson, bilge keelson, deck beams, stringers, knee, shear-brake, ribs, bulkheads and carlines. The planking of the hull is really the skin or shell. It covers the ribs and frame of the boat and may be applied in several different ways. The edge nail construction is probably the most durable for a boat which is subject to severe pounding through seas or heavy engine vibration, as the planks are narrow and are secured through both the edge and the face.

The shape of the stern of the motor-boat is also of vital importance, since it affects speed as well as seaworthiness and ability to run with the sea. For instance, the V-shaped stern shown at points *A* and *B* on page 277 may give the longest water line on a given overall length as well as the most protection to the rudder, but it is not a good design for backing or running with an overtaking sea. The "square transom" and the "rounded transom" are fairly satisfactory types, although the rounded is more expensive to construct. A "compromise stern," *D*, is seaworthy and dry when running before a storm, but it is never used on a craft where the maximum of accommodation is desired because of the large amount of deck-room which is sacrificed to its use. The old style "fan-tail" is shown at *E*. This is now almost obsolete, for the reason that it is almost impossible to back a small boat against a heavy sea because of the resistance offered to the hull by the waves. This type is inclined to be unwieldly when running with a sea, as the waves will lift the stern. A type of stern which is still popular is shown in the illustration above. It is known as the "torpedo." This type is adapted to shallow waters where a minimum draft is desired, but has a tendency to squat when the boat is under way, thereby greatly decreasing her speed. It is a good "heavy weather" type, however.

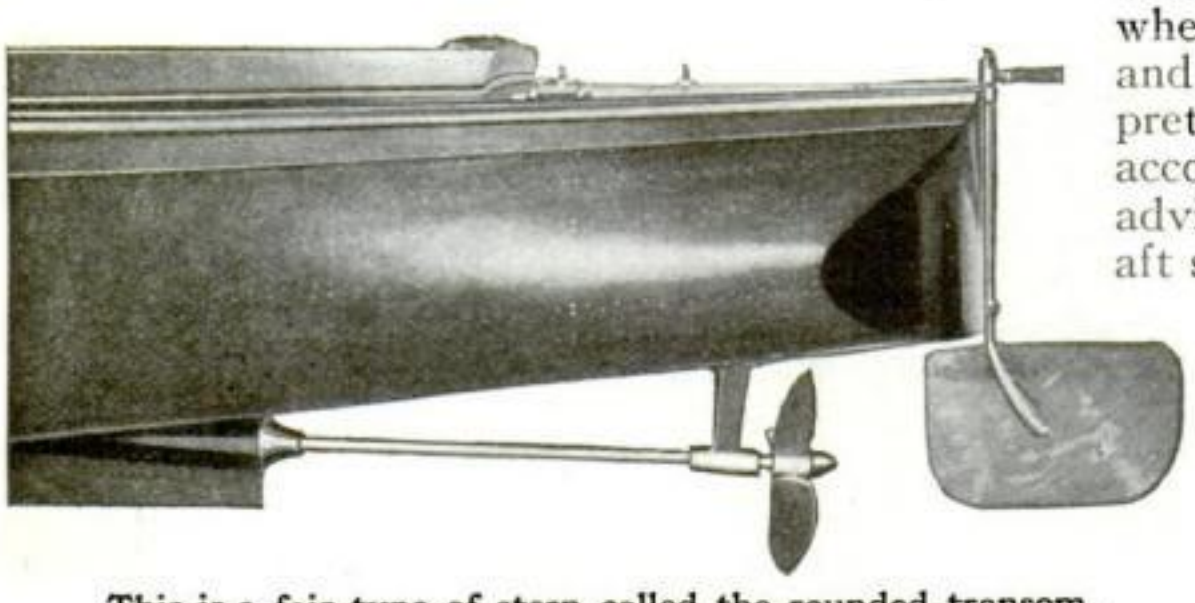
Strictly speaking, the power plant consists of the engine only, but it is customary among small motor-boat operators to include everything that is connected with the actual operation of the craft. For instance, the engine classification includes the following: the crank-case, or base of the engine; the cylinder, including the water jacket, or top of the engine; the crank-shaft upon which is mounted the fly-wheel at the forward end while the shaft connects with the rear end; the connecting rod which connects the piston with the crank-shaft, being attached to the form by means of a "wrist pin"; the carburetor, by means of which the proper amount of air is admitted with the gasoline to the compression chamber; the spark coil and battery which generate the spark which is

conveyed into the compression chamber through the medium of the spark plug; the water pump which forces the water through the water jacket and prevents the cylinder from overheating; the magneto, upon which the engine depends for its electrical energy while it is running, and the timer, or distributor, by means of which the spark occurs in the proper cylinder at the proper time, advancing the spark and increasing the speed of the engine. The lubricating system is also of vital importance and should always be kept in first class condition.



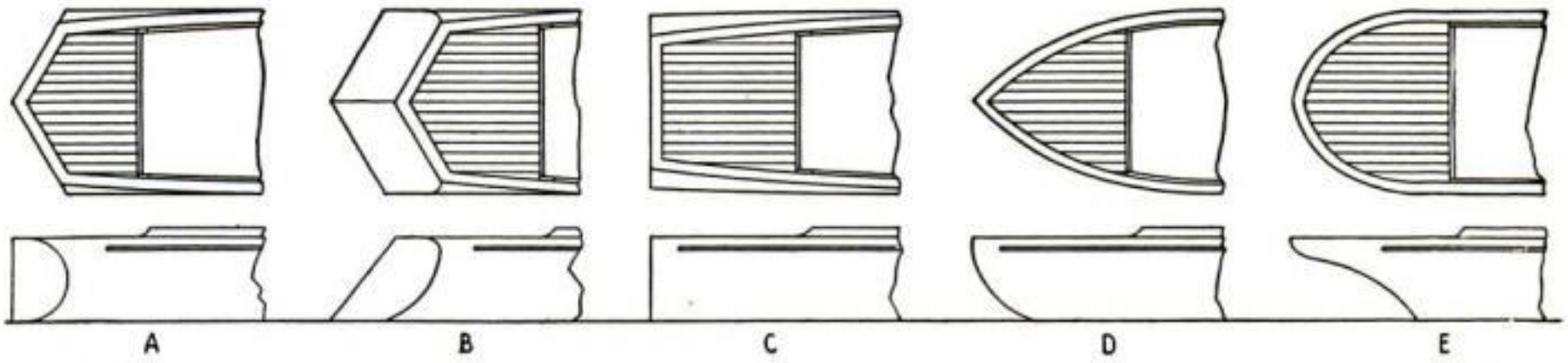
The names and locations of the various parts of a motor-boat should be memorized by the amateur boatman

In connection with the power plant we may also mention the reverse gear which allows us to start the engine without causing the boat to move in either direction and which allows us to drive the boat ahead or astern as we desire. The gasoline tank is also very important to the successful operation of a gasoline engine. The tank should preferably have a capacity of fifteen gallons, the actual size depending upon the amount of room which may be given to it, as well as on the cruising radius which it is desirable to maintain. On small boats these tanks are often flat and are situated under the forward deck, while on the larger craft they are cylindrical and are situated under the deck or amidships on each side where they will be out of the way and where scuppers may be arranged to expel any leakage which may occur. This will prevent the gasoline from getting into the bilge of the boat where the fumes may become ignited and cause serious damage. These tanks should preferably be made of copper and should be sweated and riveted together, although many of them are made of galvanized iron and merely soldered with a standing seam. The pipe from the tank to the carburetor should be of lead, copper or block tin, and be coiled sufficiently to prevent the vibration of the vessel from breaking the pipe at its connecting ends. It is also good practice to install a strainer in the pipeline to prevent foreign matter from entering the carburetor and clogging the needle valve. The proper location of the engine is generally decided by the type of boat in which it is to be used. For instance, in the "day cruiser" the engine is placed well forward so that the operator may sit in the bow of the boat and not only steer the craft, but handle the engine also, while in most of the other types of cruisers the engine is placed pretty nearly amidships so that the reverse gear lever is in the after cockpit where the operator usually stands when maneuvering the craft. One point should always be borne in mind, however, when installing the power plant, and that is to have the boat balance pretty well without a crew. To accomplish this result it is generally advisable to place the engine a little aft so that its weight will be an aid in keeping the propeller under water.



This is a fair type of stern called the rounded transom. It is expensive to make but has a very neat appearance

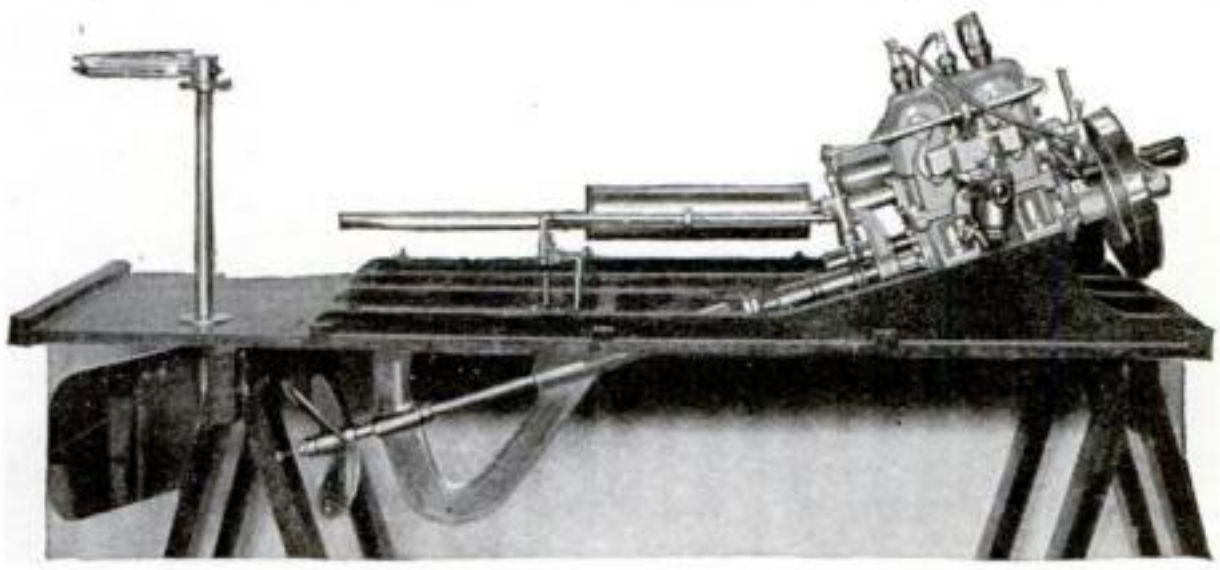
The reverse gear is generally connected up, as shown in the illustration of the engine installation, the halves of each coupling being secured together by means of about



The shape of the stern of the motor-boat is also of vital importance since it affects speed as well as seaworthiness and ability to run with the sea. Different shapes are adapted for different waters

½-in. bolts. Most of these reverse gears have three notches, the center one being neutral, so that the engine may be started without turning the propeller in either direction. The other two notches are for full speed ahead or astern. Although some of the gears are provided with two speeds ahead, the majority of motor-boat operators prefer to control the speed of the boat by the speed of the engine and the latter by means of the spark lever on the timer or distributor in about the same manner as the automobile is controlled.

There are numerous steering devices on the market, but those shown at *H*, *I* and *J* are the most popular for motor-boat use. Sketch *H* shows the common type of steering wheel where the tiller-rope passes around the drum of the wheel so that turning the wheel in either direction necessarily moves the rudder. In connecting up a wheel of this kind the turns taken around the drum must be uneven in number; that is, the tiller rope should pass around the drum three or five times and never two or four. Sketch *I* shows a lever arrangement which is very satisfactory as a side steerer, provided the guard is set low enough to allow of the lever being moved backward or forward far enough to turn the rudder at an angle of about forty-five degrees of the keel in either direction. This type of steerer is never used except on the side of the craft so that one man may handle the engine and the boat. Sketch *J* shows what is known as the auto steerer, which is a very popular type for speed craft and the larger cruisers. In this type, the wheel is between the operator's knees, so that his hands rest on it. The shaft of this apparatus projects below the floor boards and has a sprocket wheel on the extreme end, from which passes the open-link chain which the sprocket teeth engage when the wheel is turned in either direction. The first-mentioned type often causes some annoyance through the tiller rope slipping on the drum; this trouble may be overcome by using either a small woven-wire cable in place of cordage or a manila line having a woven-wire cord. With the side steerer there is very little trouble except that caused by the continual shrinking and stretching of cotton or hemp tiller rope, but even if the line should get slack it is a very easy matter to take the slack out at the eyes at either side of the lever or with a turn-buckle. The last-mentioned type is preferably used in connecting with a wire cable so that there is never any trouble through having too much play, or slack.

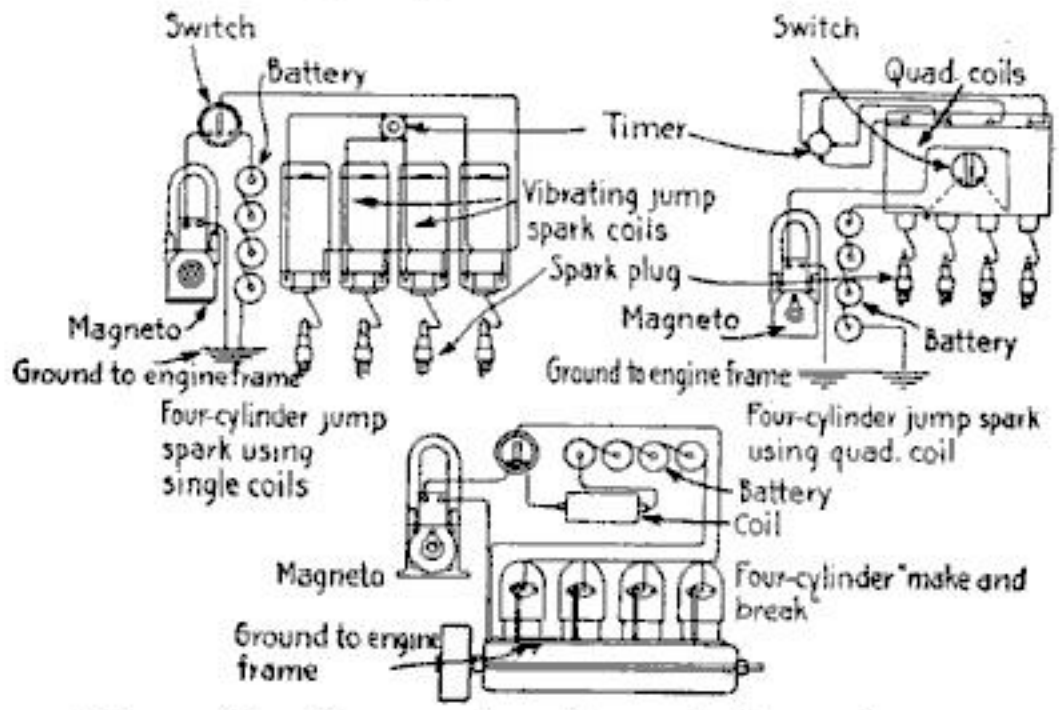


The position the engine takes relative to the boat hull for directing the shaft downward at the stern end of the boat

Another piece of apparatus which is a desirable adjunct to the modern motor-boat is the generator and magneto. These magnetos are known as high and low tension, the former being for ignition purposes only, while the latter may be used also for lighting purposes. In order to overcome the objection of the Steam Boat Inspection Service to this method of lighting, it is advisable to have a storage battery connected into the lighting circuit

so that in the event of engine failure at night, the riding lights may be connected directly with the storage battery.

There are three methods by which the magneto may be connected with the engine. They are as shown at *K*, *L* and *M* of the sketch showing the common methods of connecting the magneto to the flywheel of the engine. The one shown at *K* is termed a "friction drive," wherein a beveled leather-faced pulley is held tight to the flywheel by means of a spring or governor. A belt drive is shown at *L*. The belt is merely passed around the magneto pulley and the flywheel. Sketch *M* shows a gear-driven type. This latter type is undoubtedly the most practical for use in an open boat or where the bilge water may be splashed on the flywheel; for either type *K* or *L* will slip more or less if the flywheel gets wet. All of these magnetos are equipped with a governor to prevent them from being driven too rapidly when the flywheel is revolving at excessive speed. High tension magnetos are always geared to the engine.

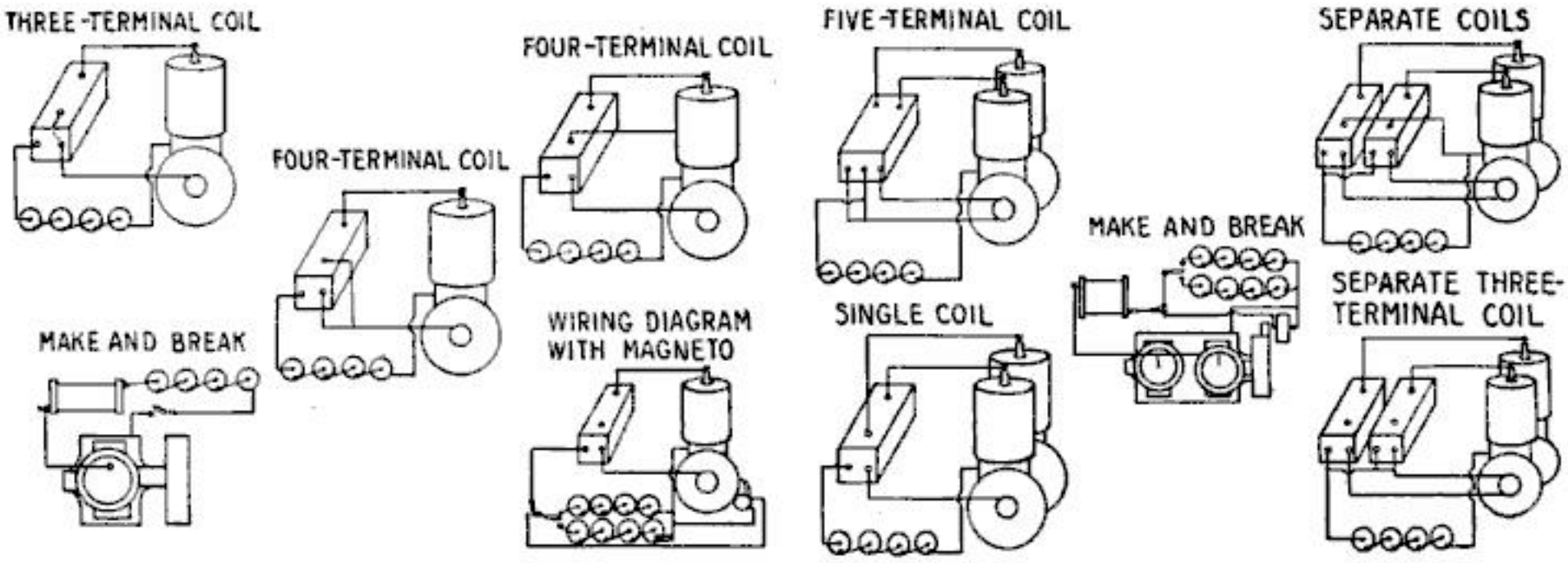


Three wiring diagrams for a four-cylinder marine engine, one for the jump spark, with single and quadruple coils and the make and break type connections

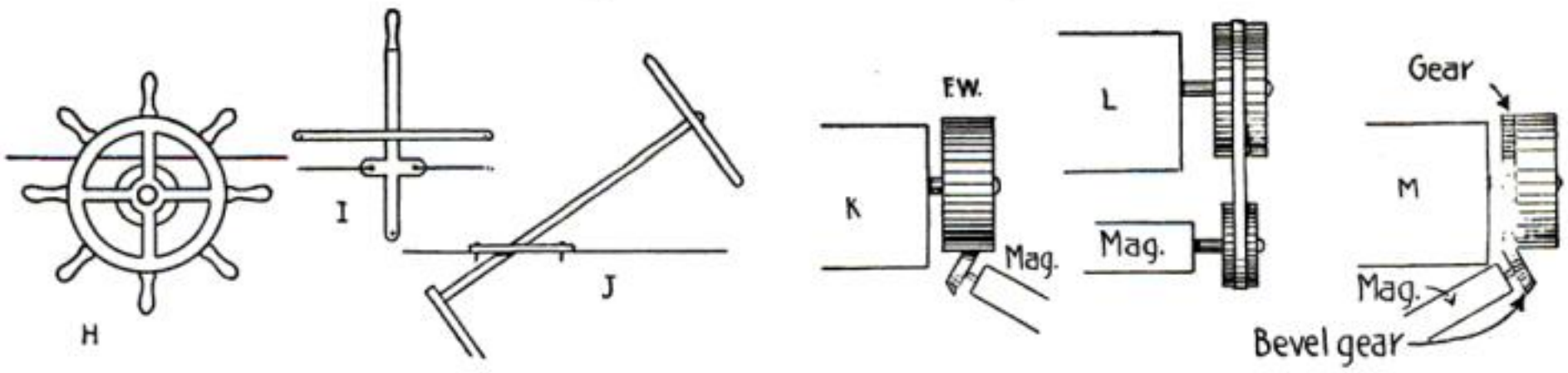
Practically all gasoline motors, especially marine engines, can be readily started whether or not the operator is familiar with his special type of engine, if the following instructions are closely followed.

To start the motor, open the valves in the gasoline line, and the needle valve on the carburetor. One turn with the thumb nut is sufficient with most carburetors. Next, close all the switches and flood the carburetor by pressing down the priming cap until a few drops leak out of the bottom of the carburetor. Now open the throttle about one-half or three-quarters and set the timer at commutator so that the engine will not back-fire. About three or four notches from the end of the quadrant is a safe position. Then grasp the handle with the fingers and take hold in such a way that if the motor should back-fire the end will slip off the handle; but never close the thumb around the handle, as a broken arm or shoulder may result. Rock the balance-wheel back and forth and give it a quick pull over center the way you wish the motor to go. The rocking operation draws the gasoline charge into the cylinder and if the proper charge is taken in, the motor will start. It is also good practice to prime the motor through the priming cock before attempting to start it, and a little oil mixed with the gasoline used for priming will be of great assistance.

After the motor is under way, advance

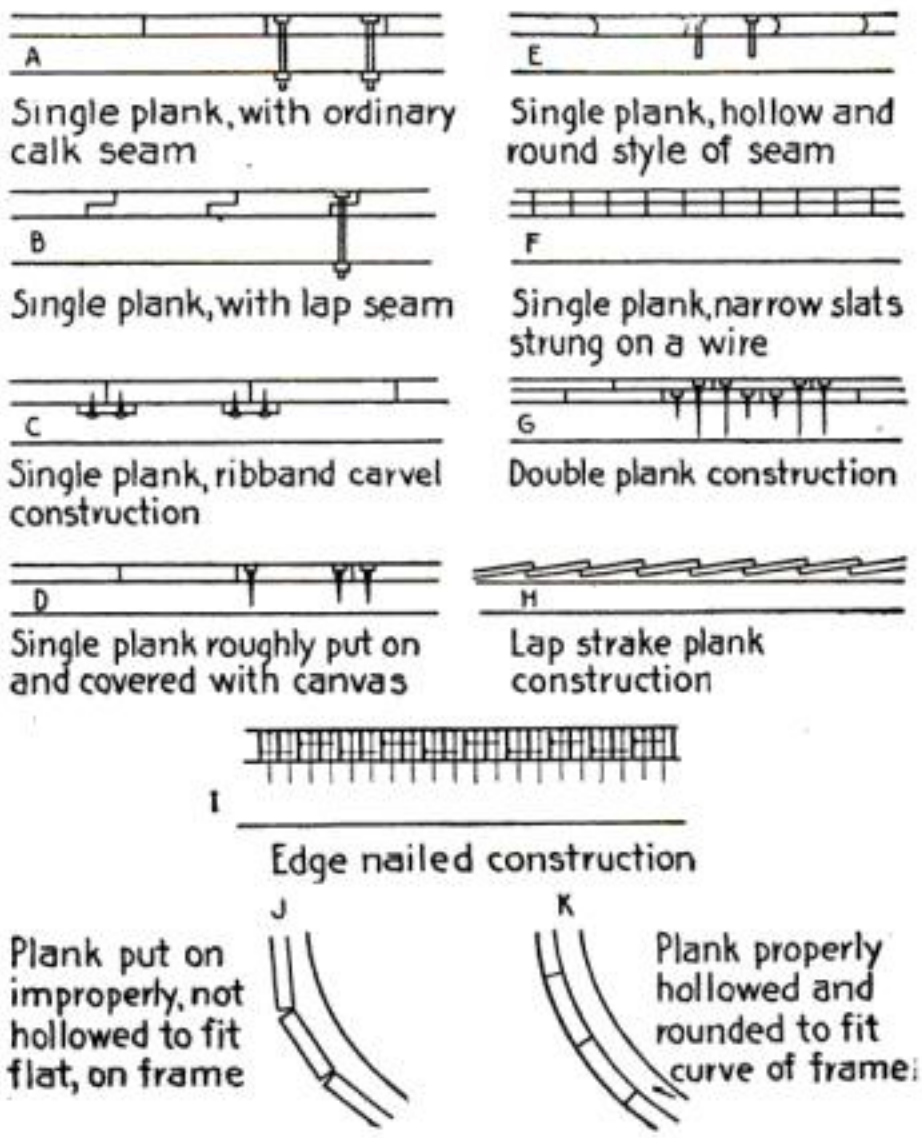


Wiring diagrams for connecting up a single cylinder as well as a double cylinder marine engine with batteries, spark coil and timer, also magneto and timer using single and double coils



While there are many steering devices on the market these three shown are the most popular

The three methods of connecting up a magneto for being driven from the fly-wheel of the engine



The planking of the hull covers the ribs and frame of the boat and it may be applied in several ways

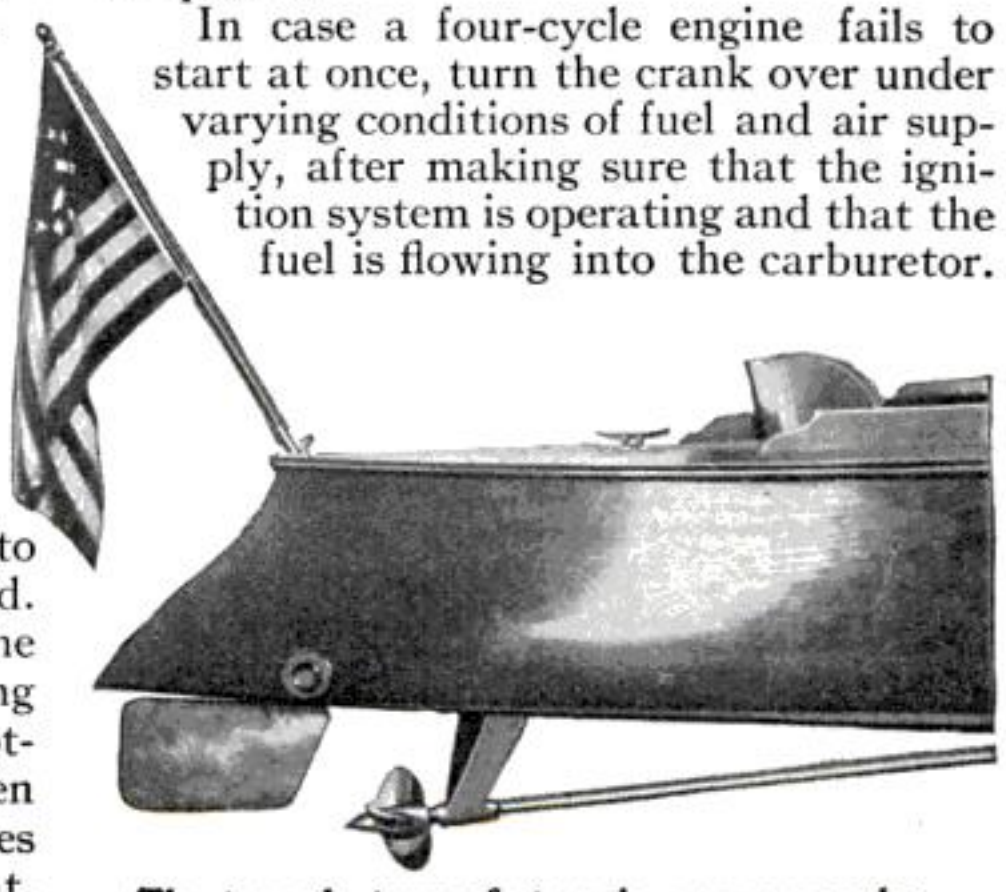
the timer until the motor speeds up, and then proceed to adjust the needle valve on the carburetor until the best results are obtained. A slight movement of the needle valve will make a great difference in the mixture being fed into the compression chamber. For that reason it is advisable to go slow and try the different points. Too lean a mixture will cause a back fire while too rich a mixture will cause the motor to slow down. When starting the motor, be careful that the mixture is not too rich. In the case of too rich a mixture close the needle valve until a blue flame is shown through the relief cock. If the motor backs fire on all carburetor adjustments the gasoline pipe or needle valve is clogged and does not allow the proper flow of gasoline.

Never use a wrench or screwdriver on a motor unless you know exactly why you are doing it. If you get a back kick or a sprained wrist from your motor, it is your own fault. Never try to start a motor with the spark advanced. The spark should be retarded before the engine crank is turned over. For throttling or slowing down, the expert uses the throttle; the amateur leaves his throttle open and retards the spark and thereby makes the motor back fire, thump and overheat.

Oil and grease cups should be filled and a small amount fed from each, always bearing in mind that too much lubrication is almost as bad as too little, as it causes carbon to form in the cylinder.

The fuel supply should now be turned on, both at the tank and at the carburetor. The needle valve on the carburetor should be opened slightly and the carburetor primed, as before mentioned, to make sure of a good supply of fuel. As soon as the engine starts, all oil cups should be opened.

In case a four-cycle engine fails to start at once, turn the crank over under varying conditions of fuel and air supply, after making sure that the ignition system is operating and that the fuel is flowing into the carburetor.



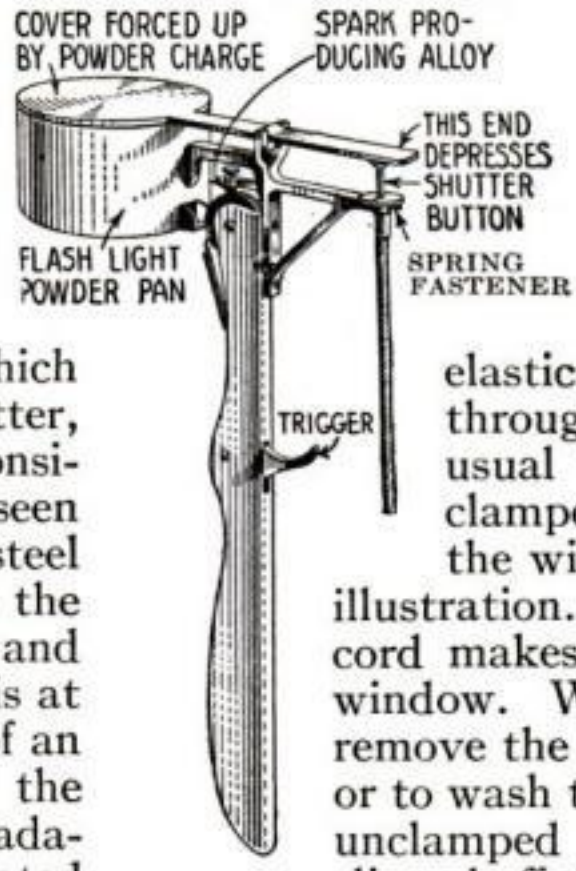
The torpedo type of stern is a very popular style and is adapted for shallow waters

Taking Snap Shot Action Pictures at Night with a Flashlight Pistol

TO take flashlight photographs the usual procedure for the photographer is first to set up his camera and tripod, open the lens with one hand, and then fire the flash powder with the other. Because of all this preparation, it has been impossible for the photographer to take instantaneous or snap shot photographs by flashlight. Now, with the aid of a novel flashlight pistol invented by a California man, the tripod is dispensed with.

By holding the camera in the right hand and the flash pistol in the left an instantaneous flashlight photograph is made.

The operation of the pistol is purely mechanical. The fact that the force of the powder explosion operates a lever which in turn manipulates the camera shutter, relieves the photographer of all responsibility. From the diagram it will be seen that the force of the explosion raises a steel lid which operates the control wire to the shutter. Hence the shutter is opened and closed at exactly the instant the flash is at its brightest. There is no possibility of an over or under-exposure. However the device permits the use of the various gradations of shutter timing. A spring-operated spark-wheel sets off the powder charge.

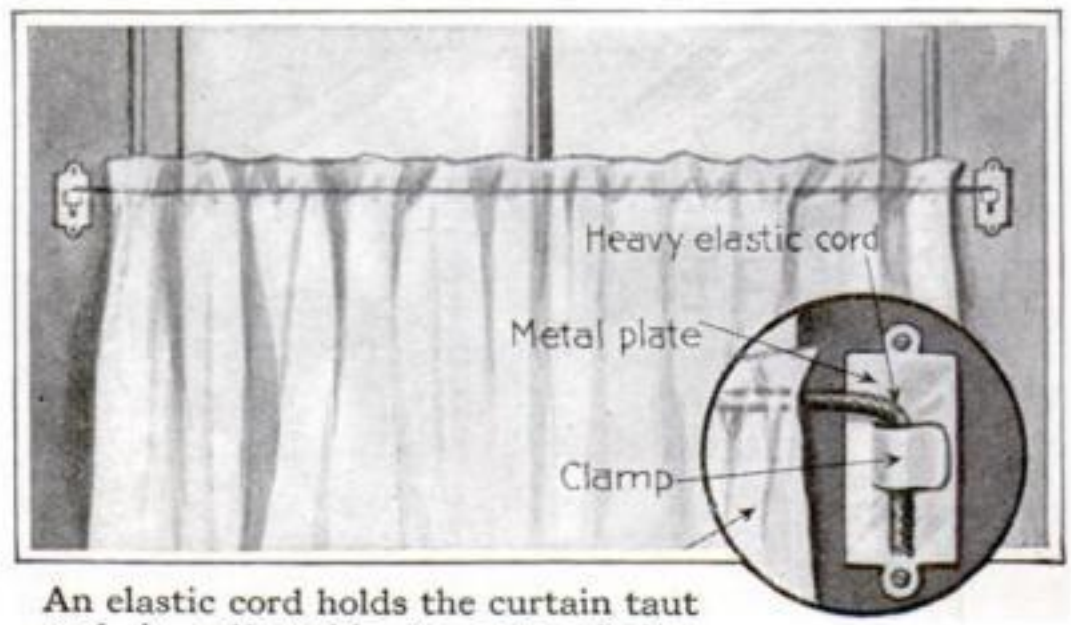


The Collection of Old Newspapers Has Become a Thriving Business

ON account of the shortage of paper, old newspapers and other waste paper have risen to an important place in the commercial world. Today the man who throws down his paper in the cars after he has finished reading it is regarded as somewhat of a spendthrift. On the Pennsylvania Railroad, for instance, waste papers are now carefully collected. Ten thousand bags have been distributed to stations, workshops and offices of the railroad to facilitate the collection, and a baling machine has been installed by the company, which bales 1,500 tons of old papers annually. This waste paper is sold for fifteen dollars per ton, so that about $22,500 is realized by the company in this way. In New York city, a social workers club is paying one cent to the children of the poor, for every pound of old paper they bring to the club headquarters.

An Elastic Cord for the Sash Curtain

AN extremely simple and inexpensive device for holding sash curtains employs an elastic cord which is drawn through the curtain in the usual way, the ends being clamped down at the sides of the window as shown in the illustration. The elasticity of the cord makes it adjustable to any window. When it is necessary to remove the curtain for laundering or to wash the window, one end is unclamped and the curtain is slipped off the cord; then the cord is looped up out of the way on the other clamp. The cord is always taut and there is no possibility of sagging.

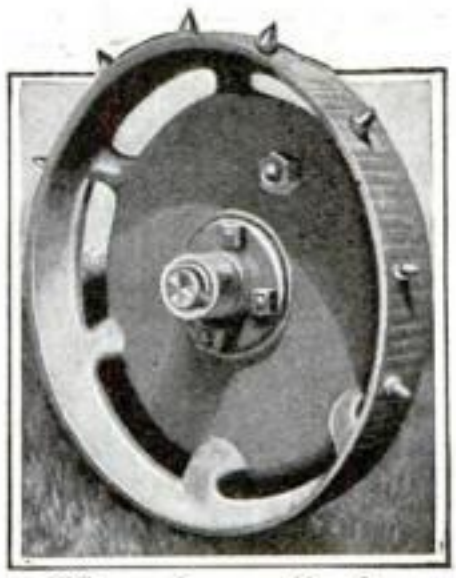


An elastic cord holds the curtain taut and is adjustable to any window

FOR PRACTICAL WORKERS

Never-Slip Calks Used on Lawn-Mower Wheels

THE wheels on a campus lawn-mower drawn by a horse became so smooth that it was impossible to cut long grass with it, because the wheels would slide. The trouble was overcome in a satisfactory manner by using the never-slip calks that are applied to horseshoes. Twelve of the calks were put in the rim of each wheel. The calks are small and will not tear up the turf, and they give plenty of tractive effect for the ordinary cutter reel in long grass.



Horseshoe calks in rim of mower wheel

Three Methods for Finding a Chosen Card

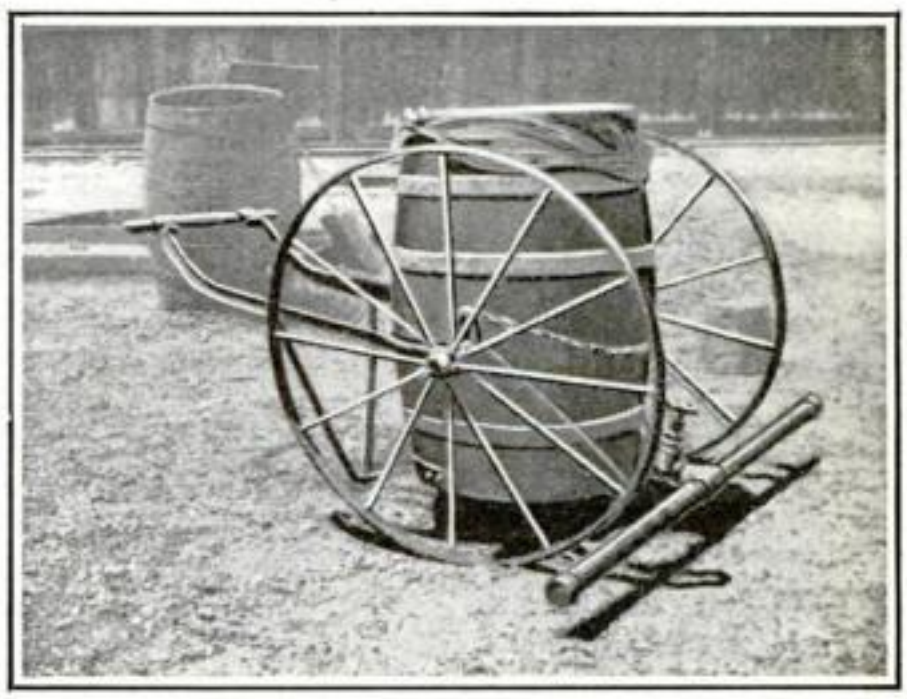
FOR this trick the chosen card must be worked to the top of the pack. If it is there already, well and good; but if not, it must be brought there by some means or other. This is generally an easy matter, even without sleight of hand, and can usually be effected under the pretense of looking through the pack. When the card is once at the top a false shuffle may be given, to throw the onlookers off the track. Then push the top card out sideways beyond the rest of the cards. Let the pack fall on the table. The resistance of the air will cause the top card to turn over and appear face upwards, all the other cards remaining face downwards.

Another method is as follows: Get the chosen card to the top of the pack. Slightly moisten the first and second fingers of the right hand, and take hold of the pack with the fingers above, thumb below. Jerk the hand containing the pack smartly downwards, at the same time relaxing the fingers, and it will be found that the entire pack falls to the floor, with the exception of the chosen card, which will stick to the moistened fingers. This will be the only card left and the card selected.

The third method is very similar to the preceding. The chosen card is worked to the bottom of the pack. Moisten the fingers slightly and take hold of the pack with the fingers below, thumb above. With the disengaged hand strike the pack smartly and at the same moment slightly relax your hold on the pack. It will be found that the entire pack will fall to the floor with the exception of the bottom card which adheres to the fingers.

Making a Push Cart Oil Sprinkler for Dusty Drives

IN mid-summer when the suburbanite is confronted with dusty driveways and walks, he will appreciate an acquaintance with the home-made oil sprinkler shown in the illustration. It consists of a steel frame mounted on wheels, that carries an ordinary oil barrel. Inserted in the bung of the barrel is a short piece of pipe



An oil barrel swung between a pair of wheels and piped to make a sprinkler device

equipped with a shut-off. To this is attached the sprinkling pipe. This pipe should have perforations about 1½ in. apart, of sufficient size to allow the oil to flow freely. The frame may be easily made by the average handy man, but where the materials are not available the local blacksmith will build it at a small cost.—J. C. GRINDELL.

Tipping Truck for a Large Cylindrical Oil Tank

BECAUSE the faucet of a kerosene oil barrel leaked more or less continually, the owner devised the tipping truck illustrated. The tank was fitted with wheels from a discarded farm spring wagon. Two cross-pieces were run under the tank, the ends being supported on cleats fastened to the spokes on each side of the tank. Two planks were laid and cleats nailed to their upper surfaces to serve as a track for the wheels. Bumper pieces were placed at the right distances on the ends of the tracks to stop the wheels from rolling farther than necessary to tip the tank horizontally. With this arrangement it is not necessary to have a faucet at all as a short piece of pipe is sufficient to guide the flowing oil into the retainer of a lamp or other receptacle.

The oil tank stands in an upright position on the wheels at the rear of the track

When it is required to fill a lamp or remove some of the oil the wheels are rolled forward tipping the tank

Waterproofing for Concrete Walls and Floors

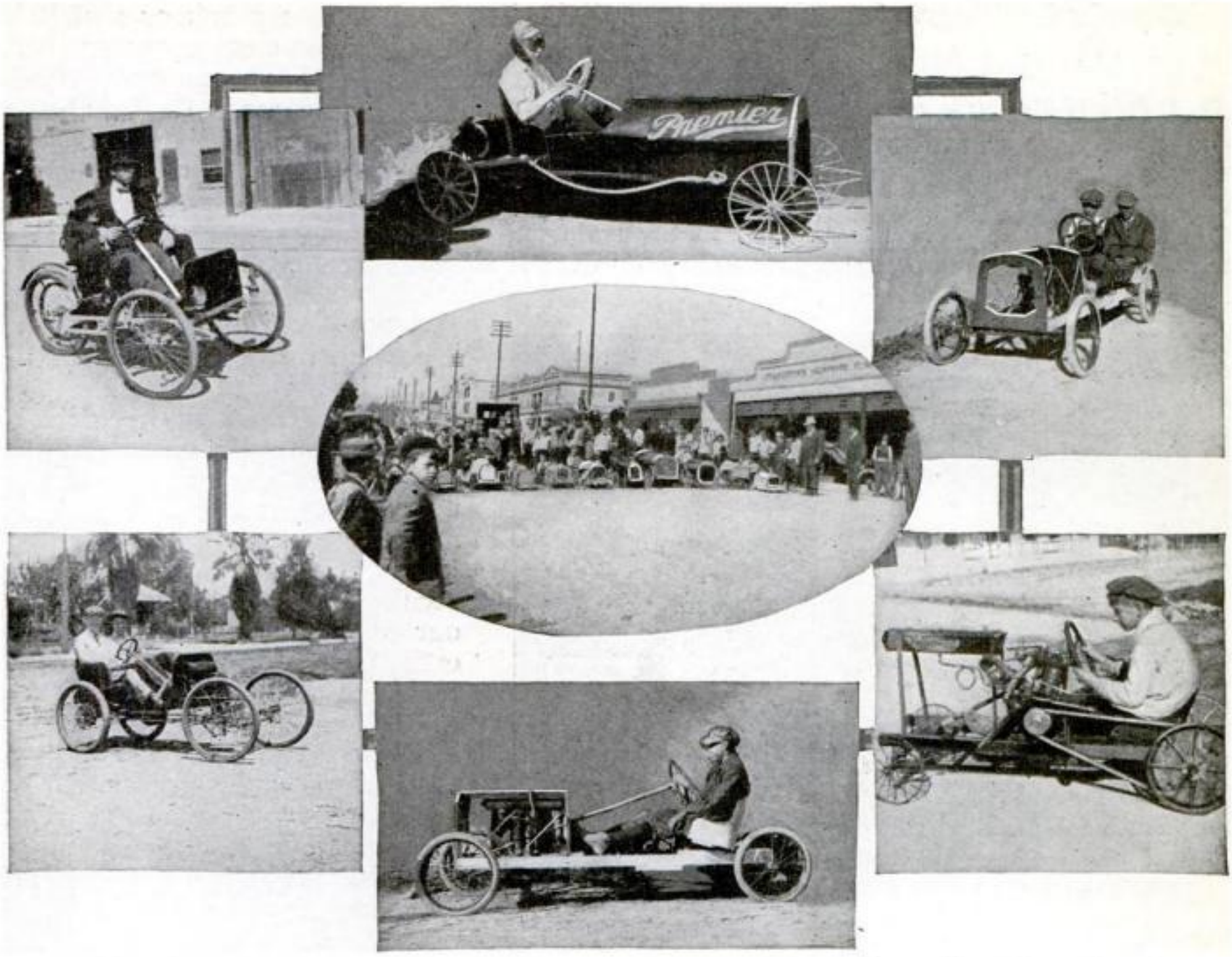
THE general impression is that concrete is water and moisture proof, but such is not the case for if the surface were flat or concave it can be made to absorb almost any amount of water that is put upon it. For certain uses, it is very important to have a waterproof concrete and the waterproofing can be done by applying a facing to the concrete surface before it begins to harden. A powder can be purchased for this purpose which is mixed with cement in various proportions up to 5 lb. to a bag of cement. This mixture is applied to the concrete surface and finished smooth with a plastering trowel—giving a fine, moisture proof wall or floor.

End Mills Made of Broken and Worn Twisted Drills

DRILLS which have been discarded because they have become too short through frequent grindings or broken off in use, still have considerable value as end mills when placed in a milling machine for cutting keyways, etc. They may be held in an ordinary three-jawed chuck, or a holder may be made up with a taper shank to fit the spindle of the machine, and a number of split bushings provided, one for each size of drill to be used.

A setscrew will securely clamp and hold the drill in position in the bushings.

They should be ground square, for what is commonly called bottoming, on the end and the clearance for steel should be about four degrees. On account of the shortness of a broken twist drill, its body will be as rigid for the work as the end mill, and owing to the construction of the shank it will stand considerable rough usage. If fairly deep cuts are to be made, each land should have a little additional clearance stoned on it right up to the edge of the flute. Considerable money can be saved in this way and the results will be almost as good as those obtained by the more expensive end mills.—A. DANE.



Race meets at stated periods stimulate the manufacture of small cars in various shapes and forms, but generally the construction of some favorite large car is copied in miniature

Miniature Automobiles and Their Race Meets

MINIATURE but practical motor-cars are being built by youngsters in California in great numbers, and of widely differing designs, and the sight of them whizzing through the streets of Los Angeles is so common that they no longer attract special attention. The rapid development of junior car building in that section is largely due to the stimulating influence of frequent road races in California, planned especially for juniors.

A racing association for boys has been formed in Los Angeles and a number of meets have been held, with cups and cash prizes awarded by motor enthusiasts.

The little automobiles are largely home-made, with the exception of the engines and some of the more complicated parts. As a rule the engine from some outworn motor-cycle is bought for a few dollars and adapted for use in a diminutive car. The steering wheel is usually secured from an auto-wrecking establishment, and the wheels may be from bicycles, motorcycles or coasters; though one or two small machines make use of the pneumatic-tired wheels designed for airplane use.

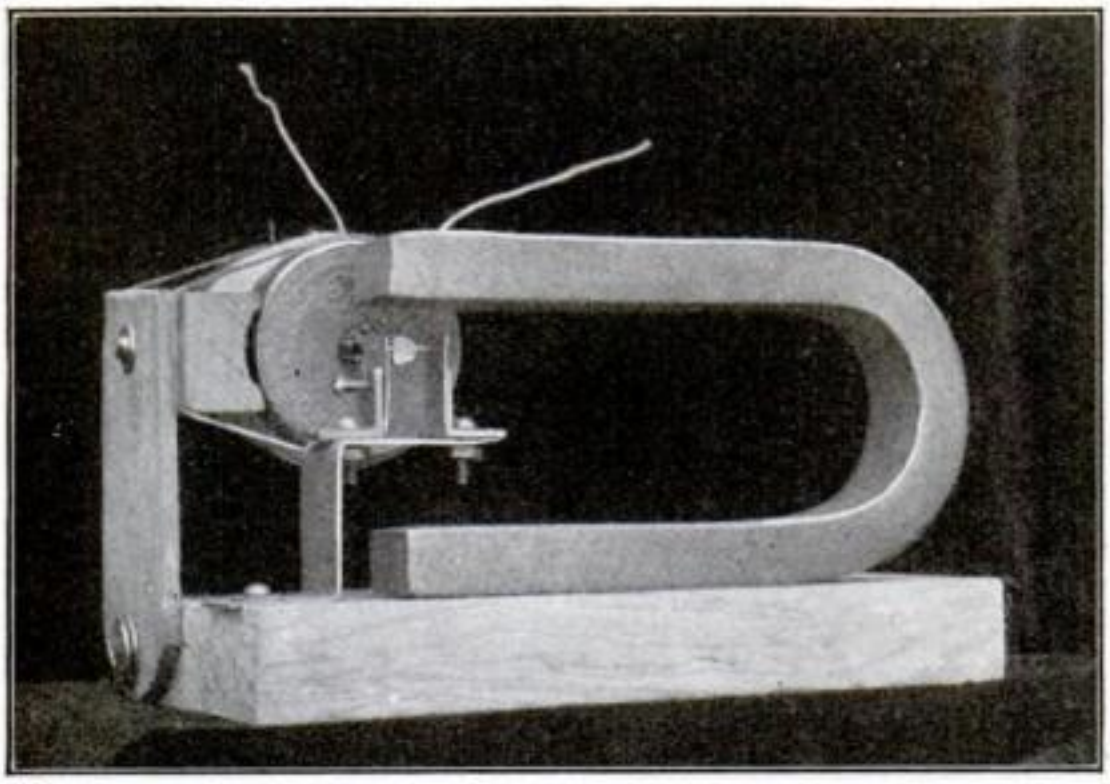
The chassis, body, transmission, steering device and gas tank are as a rule of home manufacture. It will be seen that to build a neat and efficient miniature car requires considerable ability as a woodworker, machinist and tinsmith. Of course the manual training received in the public schools is very helpful in developing mechanical skill. The photographs show a number of home-made models and one factory-built junior car.

Hanging Backing Cloth for Wall Paper

IN hanging cheesecloth or muslin for backing on which to hang wall paper, wrinkles will be prevented if you first wet the cloth with clear water and when dry size it with alum water, 1 lb. to the pail.

Simple Oscillograph to Record Current Alternations

ALTERNATING electric current derives its name from the fact that the current reverses the direction of its flow. It first flows in the wire in one direction and then dies out to zero and then flows in the opposite direction and dies out to zero or no current again. This constitutes what is known as a cycle. Alternating current of 60 cycles means that the above operation occurs sixty times every second. Alternating current is graphically represented by what is known as a "sine curve" as shown. Just why this curve represents alternating current may be shown by a simple experiment as follows: Take a piece of paper and lay it flat on the table. With a pencil in one hand, draw a mark by vibrating it rapidly across one end of the paper, the pencil retracing its own mark back and forth. At the same time, with the other hand draw the paper from beneath the pencil point and in a direction perpendicular to the line you have been drawing. The result will be as illustrated on the following page and represents a sine curve although imperfectly. Had you been able to vibrate the pencil regularly and draw the paper along at a regular rate of speed, the result would have been a perfect sine curve.



The coil mounting and the coil, and the manner of mounting a tin can on a disk phonograph to carry the film

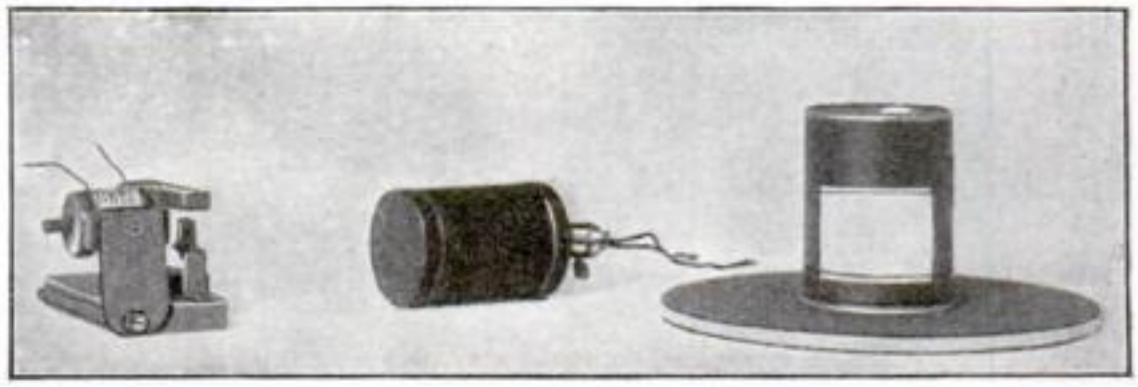
The above is exactly what an oscillograph does, excepting that a photographic film is substituted for the paper and a spot of light for the pencil point. The spot of light is reflected from a mirror which is being vibrated by the electric current. A Braun Tube oscillograph operates somewhat differently, however, no mirror being used.

The illustration shows a simply made oscillograph, and, while imperfect in its action, very interesting results may be had with it in studying alternating current and its rectification.

A rectified alternating current is one in which the current pulsations have been changed (by electric, mechanical or chemical means) so that the current flow is in one direction only, as in the familiar aluminum-cell electrolytic rectifier.

The trouble in making an oscillograph is to get away from our old friend (or enemy) "inertia," which an eminent scientist once described as "the pig-headedness of matter." Matter in motion seems to want to keep on moving and matter at rest wants to stay at rest and it requires force to either start or stop it. The earth keeps on revolving because it is a large heavy mass and does not seem to meet with much resistance. If you have ever tried to push an automobile out of a garage you will remember that it was comparatively easy to keep it moving after you had once got it started.

This is exactly the trouble in making the little mirror and moving parts of the oscillograph. They must be made very small and light to get the best results so that when the electric pulsation starts, the little mirror (influenced by it) starts, and when the current stops the mirror will stop. This is not possible to realize in practice but it may be approximated. With alternating current of 60 cycles there are 120 current pulsations per second and

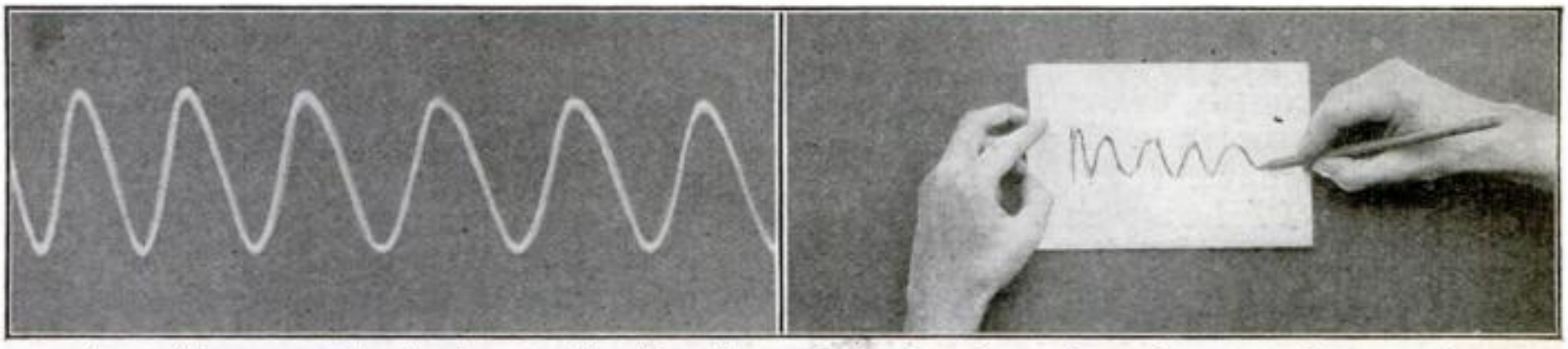


The coil and magnet mounted on a base, and the delicate mechanism of the moving parts for casting the light ray

it keeps the little mirror very busy trying to follow them.

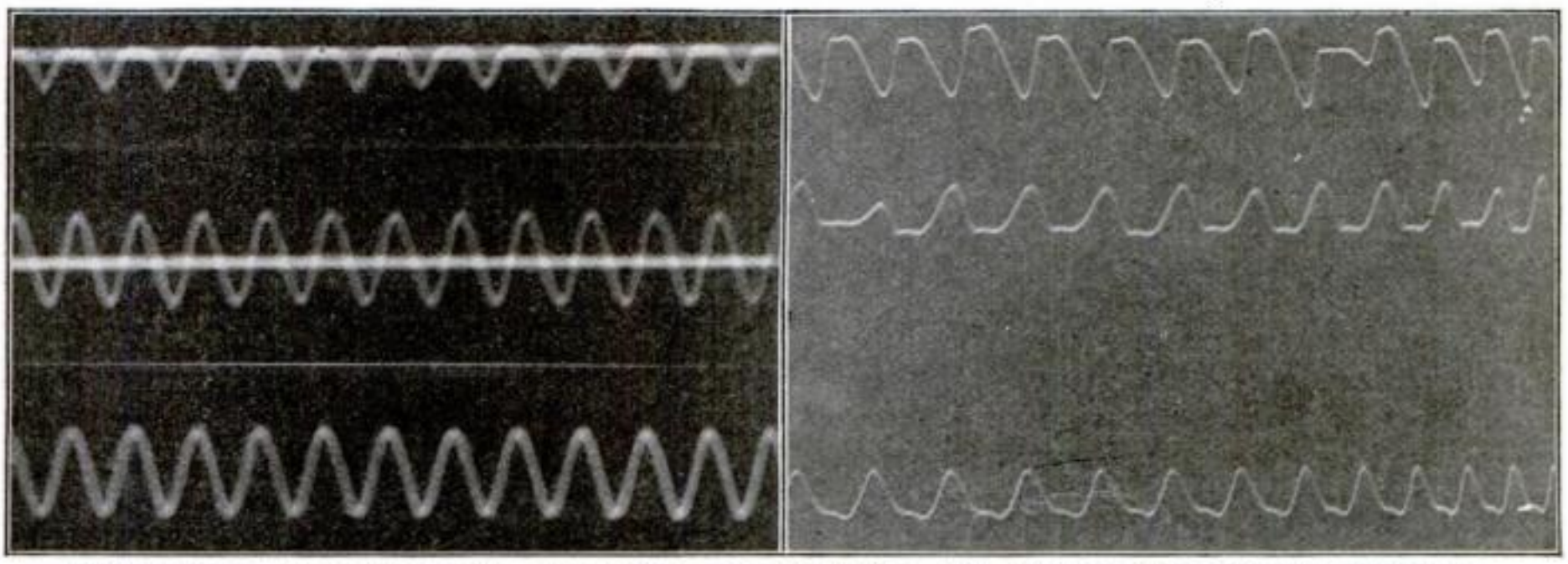
As shown, the shaft of the moving part consists of a small brass pin sharpened at both ends and with bearings made by small dents (not holes) in the two pieces of thin sheet brass. A small piece of iron wire is fastened at right angles to the brass pin with a drop of glue or sealing wax. A mirror (somewhat larger than the head of a pin) is glued to the center of the iron wire. The mirror is best made from a microscope cover glass. This is a small square of very thin glass and may be dropped into a test-tube of silvering solution for which there are various formulæ. The test-tube should be of such size that the glass will just fit into it. This will support the glass upright in the tube so that it will be evenly silvered on both sides. The silver coating is afterwards removed from one side of the glass by touching it with the end of a tooth-pick moistened with nitric acid. After washing and drying, the mirror is broken into bits and a small piece selected as nearly round as possible. A piece of the silver chipped off the back of an old mirror might be used in place of a mirror.

By means of the small screw, the tension of the bearings on the shaft is made adjustable so that the mirror will not swing too far. This dampening effect is quite desirable in making oscillograms of rectified current, so that the mirror will not swing beyond the zero point. With 110 volt A.C. a lamp or other resistance should be placed in series with the coil of wire. If a core is used, it should be made up of small iron wires. The size and amount of wire necessary on the spool or electromagnet is best found by experiment. The spool is fastened by rubber bands to the support, making it easy to substitute various spools containing different sizes and lengths of wire. Very little current is required as the mirror is influenced by the electromagnet at considerable distance from it. The mirror and moving part should be mounted a little nearer to one pole of the permanent magnet than the other, so that the spot of light is adjustable by moving the permanent magnet backwards or forwards as desired.



An oscillogram and a simple way of making the curve by drawing a piece of paper under a moving pencil to illustrate the process by which the recording oscillations are made by the machine

As a source of light, sunlight is excellent for viewing the oscillograms directly. The sunlight is allowed to fall on the mirror and is then reflected on to a piece of white paper as a spot of light. When the mirror is being vibrated, the spot of reflected light



Oscillograms of a sixty-cycle alternating current before and after rectification, the zero line, indicated by a straight line in the first two, being photographed without a current in the coil

becomes a line, as in the experiment with the pencil and paper. By waving the paper screen back and forth rapidly in a direction perpendicular to the beam of light, the oscillograms may readily be seen. This effect is due to the persistence of vision. A small hand magnifying glass placed between the mirror and the paper screen tends to sharpen and brighten the image of the light spot. For photographing the oscillograms, sunlight might be used by reflecting it through the keyhole on to the mirror in a dark room. On account of the movement of the sun, however, the spot of light has an annoying way of moving off the mirror just as all adjustments for taking the photo have been made; therefore a small incandescent lamp is more satisfactory.

The lamp used in this case was similar to those used for automobile headlights and was a 6-volt 16-candle power lamp with a small concentrated tungsten filament known as "focusing type," it being essential that the light should come from as small a point as possible. A storage-battery was used, which gave a somewhat higher voltage than that of the lamp. This gives a light of greater actinic power although not conducive to long life of the lamp. The lamp was enclosed in a light-tight box painted black on the inside and having a small hole through which a beam of light might fall direct from the filament on to the mirror.

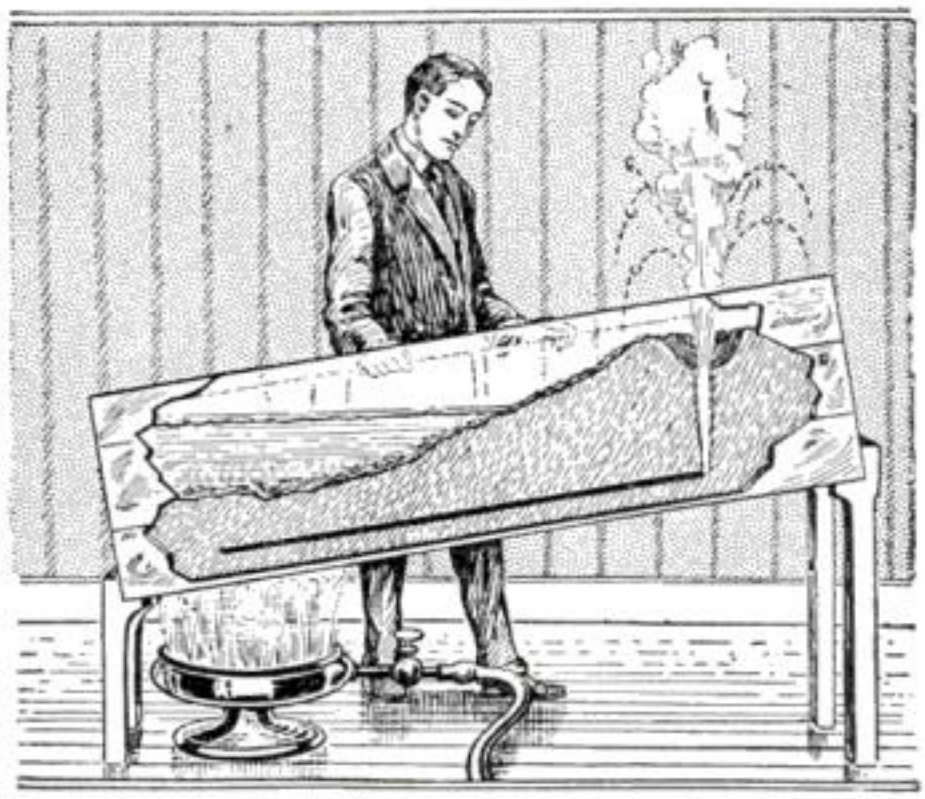
A photographic plate may be drawn by hand rapidly across the beam of reflected light and the image obtained thus, although the results would be imperfect owing to the difficulty of moving the plate rapidly, evenly and uniformly. The uneven oscillograms shown were taken on a plate moved by hand.

A disk phonograph was hit upon as being a device which revolves smoothly and at a regular speed. A hole was punched in the exact center of a coffee can, and fitted over the little knob in place of a record. The can was covered with black paper to prevent reflections. After focusing the spot of light on to the can, a piece of photographic film was fastened around the can with rubber bands, a piece of cardboard between the mirror and film acting as a shutter. The phonograph was given a chance to get up speed and the shutter was opened and closed again when the phonograph had gone around *once*. One revolution is best gauged by fastening to the revolving table a piece of wire or cardboard so that it will brush past a finger held near it, when the piece of film has *just passed* the beam of light. When the wire touches the finger, it is a signal to open the shutter and the next touch is a signal to immediately close it.

Oscillograms are shown of an alternating current of 60 cycles before and after rectification. The zero line is photographed by allowing the phonograph and film to revolve once while the spot of light is at rest. This may be done before or after making the oscillogram. The oscillogram shows the rectification caused by a one-cell aluminum rectifier consisting of a lead plate and the tip end of an aluminum wire dipping into a solution of sodium phosphate.

A Home-Made Steam Volcano to Explain Volcanic Activity

BELIEVING that steam causes the activity of volcanoes, a Frenchman has used that agent in imitating Nature in a most realistic way, as illustrated and described in *La Nature*. The whole experimental volcano is made in a shallow basin about 2 ft. square, in which a wet mixture of

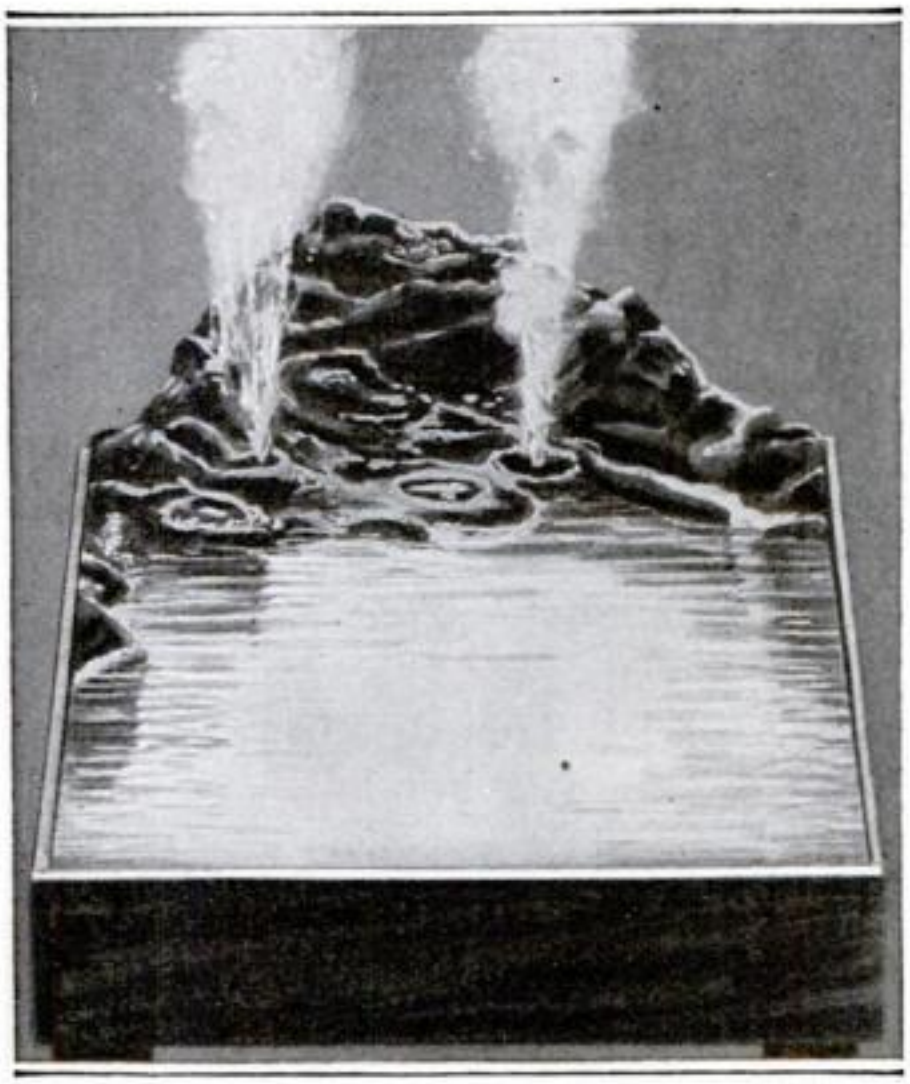


A sectional view of miniature earth works showing what takes place in volcanic action

sand and clay is placed so that the lower side represents the sea and the upper side the land. The basin is placed in an inclined position, the higher part holding the land and the lower part the water. The metal basin provides a way to heat the bottom so that an even mean temperature is obtained on the surface. When the flame of a gas jet is applied, as shown,

it takes only about 10 minutes for the volcanic phenomena to begin to appear.

In Nature layers of hard rock or similar obstruction may deflect the rising fumes,



The miniature volcano in action as it appears from the lake end of the box

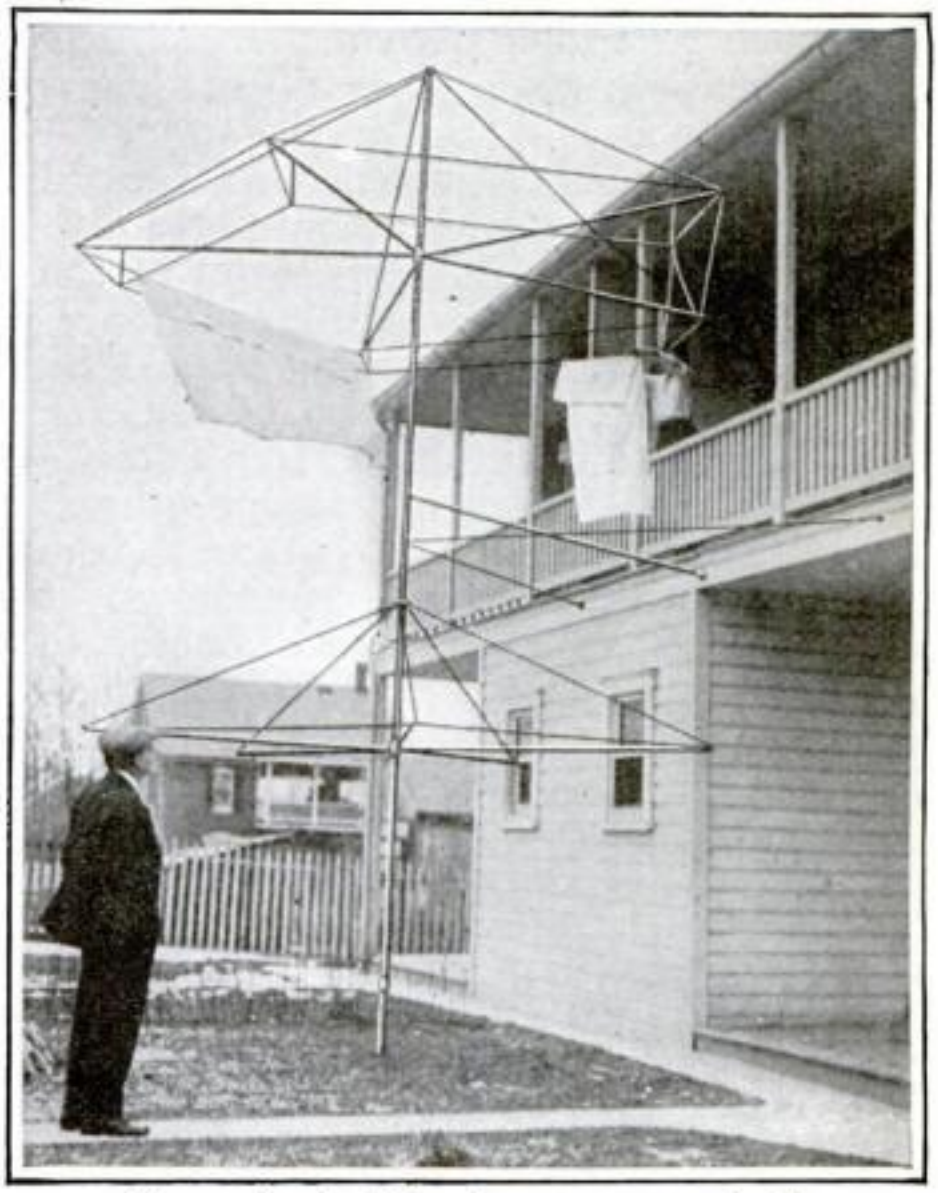
and this may be imitated by placing a sheet of slate in the sand, as the dark line shows, a short distance from the bottom of the basin. With this plate in the sand several volcanoes may be produced in line with its upper edge. By this arrangement the volcanic action will appear at some distance from the source of heat. This illustrates how linear groups of volcanoes are formed in Nature. By varying the positions and the number of plates the volcanic action may be concentrated near the top.

A Solution for Reclaiming Over-Exposed Blue Prints

WHEN washing blue prints, if 10 drops of peroxide are added to each gallon of water a solution will be made that will produce even blue prints. The blue print is washed as usual in clear running water, after which it is placed in the peroxide solution and is finally washed in clear water to remove all traces of the salt. A blue print of correct exposure or one under exposed will not be affected by it, but in over exposure the chemical will restore it to the true color. Where old blue prints have become faded this solution will restore them.

A Double-Deck Revolving Clothes Hanger for a Yard

WHERE backyard space was at a premium, the double-deck clothes-line apparatus, shown in the illustration, was made to serve the purpose of drying as satisfactorily as the ordinary line that takes up so much room. The double-deck arrangement is built on a center upright made of 25 ft. of 2-in. galvanized pipe purchased from a local plumber. The arms consist of 10 sections of 1-in. pipe about 6 ft. long, threaded on both ends to fit into caps and bands that slip over the center pipe. The bands are movable, being held in place by a shoulder. Wires are strung around from end to end of each extension and each arm is supported by a wire. Two of these are placed on the center post, one for the ground level and the other for the second floor porch. The height for each hanger is adjustable. The lower hanger can be made just as high as it is desired by the person using it. The top circle can be arranged to reach the rear window or porch. The main pole is embedded in 3 ft. of concrete, affording a rigid foundation. The apparatus covers a circular space of the back yard about 12 ft.

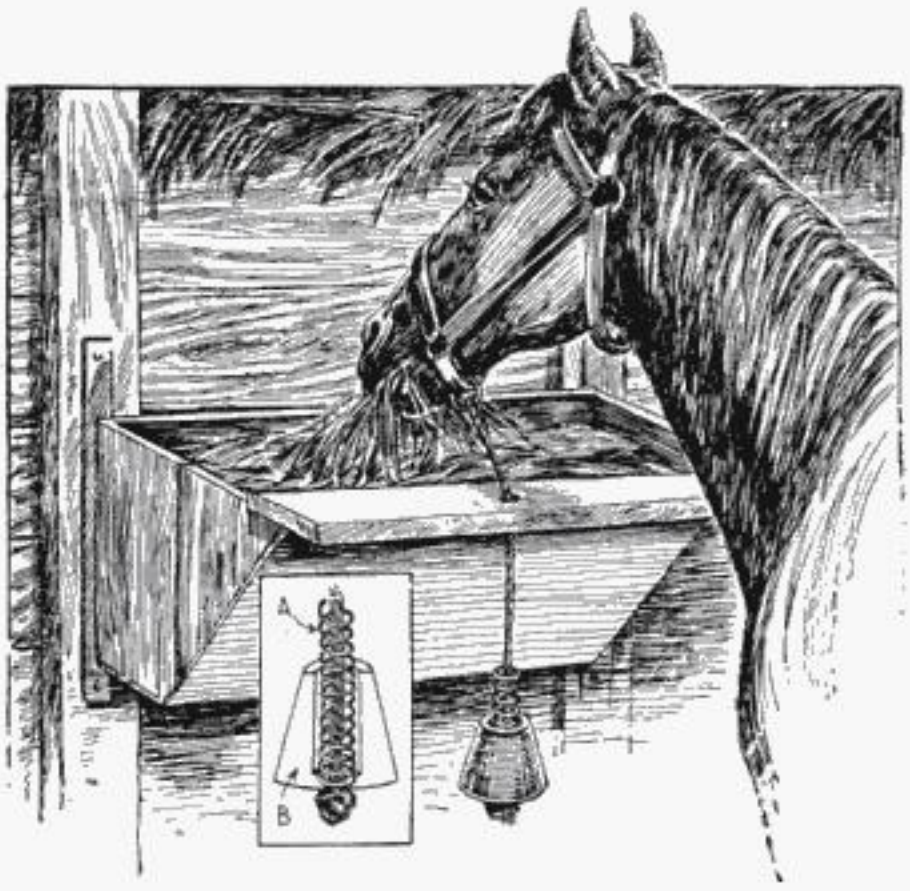


Two sets of clothes hangers on a single pole serving a two-apartment house

in diameter and has more than 150 ft. of hanging space.—CHARLES M. STEWART.

To Prevent a Colt from Becoming Tangled in a Halter Rope

IN the illustration a device is shown that will prevent a colt from becoming tangled in the tie-rope of the halter. The



The weight keeps the tie-rope taut all the time and the spring cushions the jerks

old method of a weight is used, but a spring is applied to cushion the jerk a colt will give when first tied with a halter. The weight consists of a piece of hardwood 4½ in. long and 3½ in. in diameter. A 2-in. hole is bored in one end of the wood 4 in. deep, and a 1-in. hole bored through the center of the remaining ½ in. of the wood. This makes a seat for the coil-spring *A* to *B*. The spring should be 8 in. long, of the open variety and made of wire about 3/16 in. in diameter. The tie-rope is passed through the spring and secured by a knot at the bottom of the block as shown. The hole in the manger should be about 1¼ in. in diameter to take the tie-rope loosely. This will effectually prevent the spring from passing through.—J. O. McDonnell.

Effects of Oil and Grease on Rubber Tires

IT is pretty generally known that gasoline, grease, oil and other fatty substances are solvents of rubber.

If garage floors are not kept clean and tires stand in a pool of oil, the treads soften and the traction strains in service stretch the rubber in a wavy outline, eventually causing it to separate from the fabric body underneath.

Probably the most damage is experienced from grease, in the differential housing, working out into the brake drums and then on to the side walls of the tires. This may result from loose bearings, too much grease or from using grease not suitable for differential.

Grease and oil may be very easily removed by using a rag saturated in gasoline. Gasoline, although a solvent, evaporates quickly, and, if applied in small quantities, will not cause any injury when used as a cleaning agent.

Ordinary injuries to the rubber cover do not prevent successful repairs but not often can work be well done when materials have been affected by oil or grease. Invariably blistering during vulcanization results.

An Irish Thrush Rings for His Food

FOR a token of remembrance of a trip abroad a lady promised a friend that she would bring back a bird of some kind. An Irish thrush was selected. When caged the bird cultivated the habit of pounding the metal bottom of his inclosure with a small gong top, taking hold of the edge with his bill and manipulating it just as a

Calling for food by ringing a string of sleigh-bells which have been hung from the cage top

workman does a pick. When his mistress fails to keep his food cup filled he jingles a string of sleigh-bells that are fastened to the cage top.

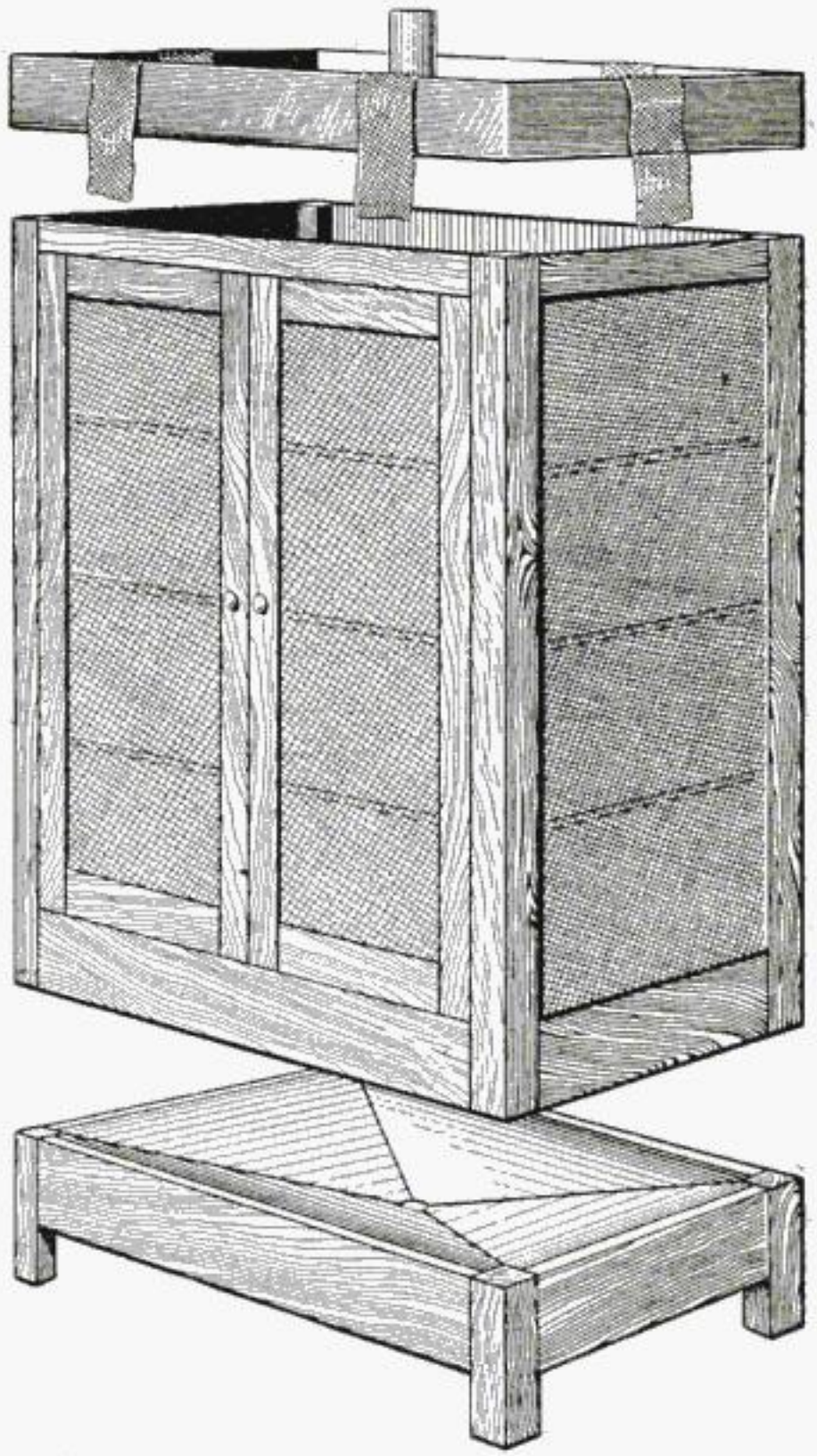
Iceless Refrigerator Using Evaporation for Cooling

IT is not always convenient or possible to have ice for refrigeration. When such is the case, as in a camp or isolated places, the evaporation method may be applied. Milk or butter will keep much better by this method than in the regular ice-box or refrigerator. A very satisfactory iceless refrigerator may be easily constructed as shown in the illustration. The measurements given are not arbitrary, as any size suitable for needs may be used, the entire cooling process being the result of the evaporation of the water as it flows down the burlap curtain forming the sides of the cabinet.

A suitable cabinet for ordinary purposes is about 18 in. wide, 36 in. long and 40 in. high. It consists of a skeleton framework of corner posts 2 in. square with a base and top band made of a board 1 in. thick and 6 in. wide. The side to be used for the front is fitted with two doors built up just as frames and hinged to the corner posts, meeting at the center just like cupboard doors. All of these openings are filled with burlap set in so that the outside surfaces will be flush with the outside surfaces of the corner posts. This may be done by building a light frame of quarter-round or light stock just to fit in the panel. Stretch the burlap over the panels and push them into the panel opening from the inside of the box frame. When this part is complete it makes a burlap inclosure without top or bottom.

The bottom or support is made of a frame the same size as the main box with corner posts about 10 in. long and the band the same as for the top and bottom of the box frame. Within this box frame build an inverted pyramid of galvanized sheet metal, allowing the edge to come up and over the edge of the side rail on the base; then extend it up about ½ in. In the center of the pyramid solder in a metal tube for a drain. The upper projection of metal will catch any overflow of water and lead it to the center drain pipes.

The top consists of a galvanized pan or tray the same size as the box frame and about 4 in. high, with a ventilator pipe soldered in the center. This pan is placed on top of the box frame. Wicks 4 in. in width are hung over the edge so that they will come in contact with the burlap sides. These wicks will evenly and slowly siphon the water placed in the tray to the burlap sides. A little experimenting will be required to get the size of the wicks right for the proper flow of water. These can be made of lamp-wick web or felt. The size may require altering according to the weather, as some days will be more humid than others.



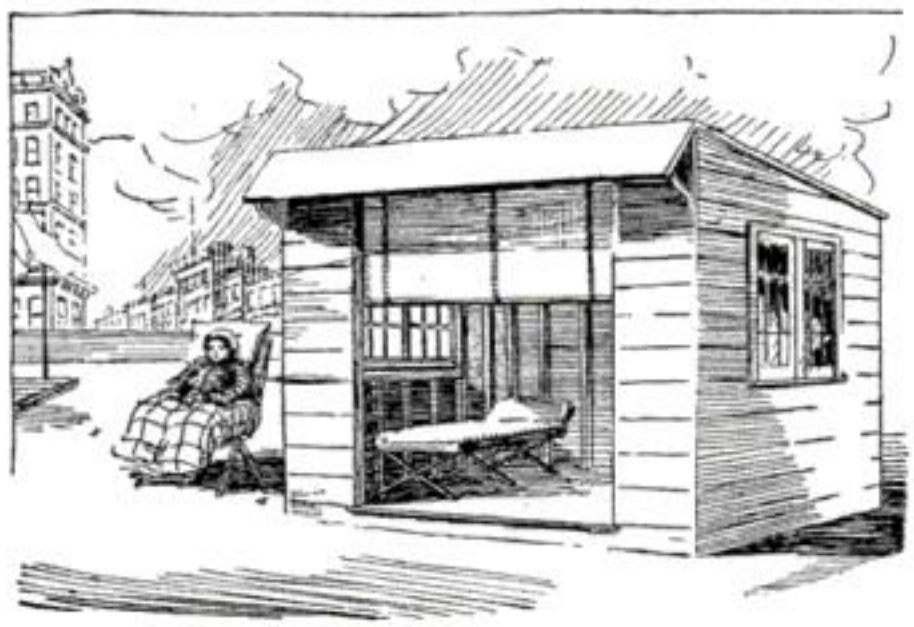
The refrigerator is made in three pieces, the center part having sides of burlap

Before placing the box frame on the base, small blocks of wood or the ordinary furniture domes should be used under each corner post so that a space will be provided for the proper draining of the water. Shelves may be placed inside to rest upon brackets fastened to the corner posts. The edges of these shelves should not touch the burlap in any place.

As such a refrigerator depends on the evaporation of water in air currents the box should be placed where there is a slight draft to produce the right circulation. The air passing up through the center tends to draw the damp air from the sides.

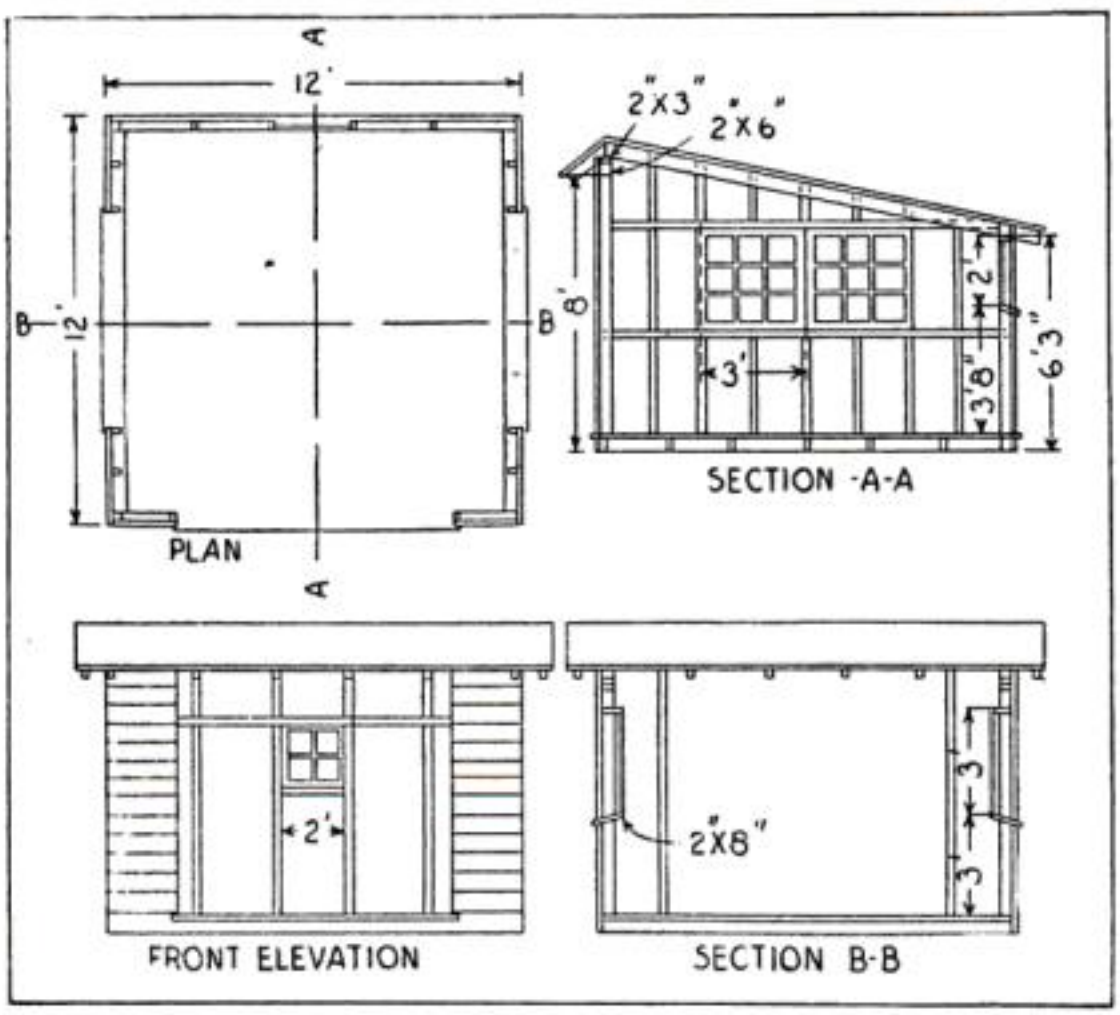
An Open Shelter for the Yard or Flat Roof of a Building

THE flat roofs of tenement and apartment houses in large cities are often used as breathing places by the tenants. Shelters can be built upon them at small cost as protection from sun and rain. Our illustration shows one of these shacks, which is the result of the campaign for the prevention of tuberculosis by the New York State Department of Health.



The flat roof space on tall buildings in all cities provides an excellent place for the shelter

In the construction, 2 by 4-in. timbers are used for the frame, and siding boards for the back and sides. The front of the shack should face slightly to the east of south and be left open, but it should be provided with a canvas curtain, tacked on a roller so that it may be closed in stormy weather. The most economical materials are rough boards for the frame and tar paper or something similar for roofing. The material list is as follows:



Plans for the construction of an open air shelter shack for a yard or open air sleeping quarters on a flat roof

4 sills, 12 ft. long by 2 by 4 in.
5 floor joists, 12 ft. long by 2 by 4 in.
14 studs, 14 ft. long by 2 by 3 in.
5 plates, 12 ft. long by 2 by 3 in.
1 front plate, 12 ft. by 2 by 6 in.
1 rail for sliding sash, 12 ft. long by 2 by 8 in.
9 rafters, 14 ft. long by 2 by 4 in.
300 ft. of novelty siding.
250 ft. of shiplap roof boards.
½ roll of roofing material.
10 pieces of 1-in. round for roofing.
1 canvas curtain on roll.
4 sliding sash; 1 casement sash and frame.
Strips of sliding sash, hardware and paint.

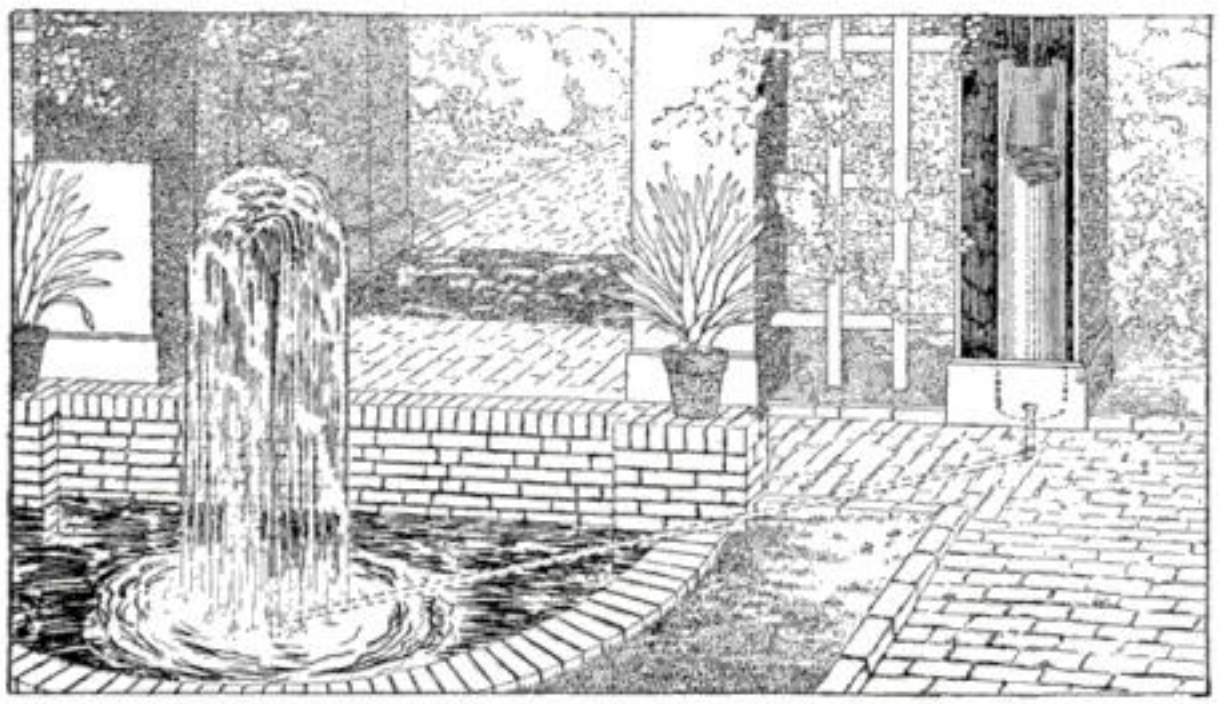
Sterilization Is the Essential Factor in Canning Vegetables

THE great secret of canning or preserving lies in complete sterilization. The air we breathe, the water we drink, all fruits and vegetables, are teeming with minute forms of life which we call bacteria, or molds, or germs. These germs are practically the sole cause of decomposition or rotting. The exclusion of air from canned articles, which was formerly supposed to be so important, is unnecessary provided the air is sterile or free from germs. The exclusion of air is necessary only because in excluding it we exclude the germ. In other words, air which has been sterilized or freed from germs by heat or mechanical means can be passed continuously over canned articles without affecting them.

Germs which cause decay may be divided into three classes—yeasts, molds, and bacteria. Yeasts are easily killed, so they can be left out of consideration in canning vegetables. As a general rule, molds are likely to attack jellies and preserves. The spoiling of vegetables is due primarily to bacteria. Bacteria are also much more resistant to heat than yeasts. They thrive in products like milk and in meats and vegetables rich in protein, such as peas, beans, etc. Keeping these products at boiling temperature for about 1 hour, upon two or three successive days will kill all bacteria, even the seed forms, which are difficult to destroy.

A Self-Acting Fountain for the Home Conservatory

THE making of any contrivance which when started works automatically and continually on its own power, is always a satisfaction to those mechanically inclined,



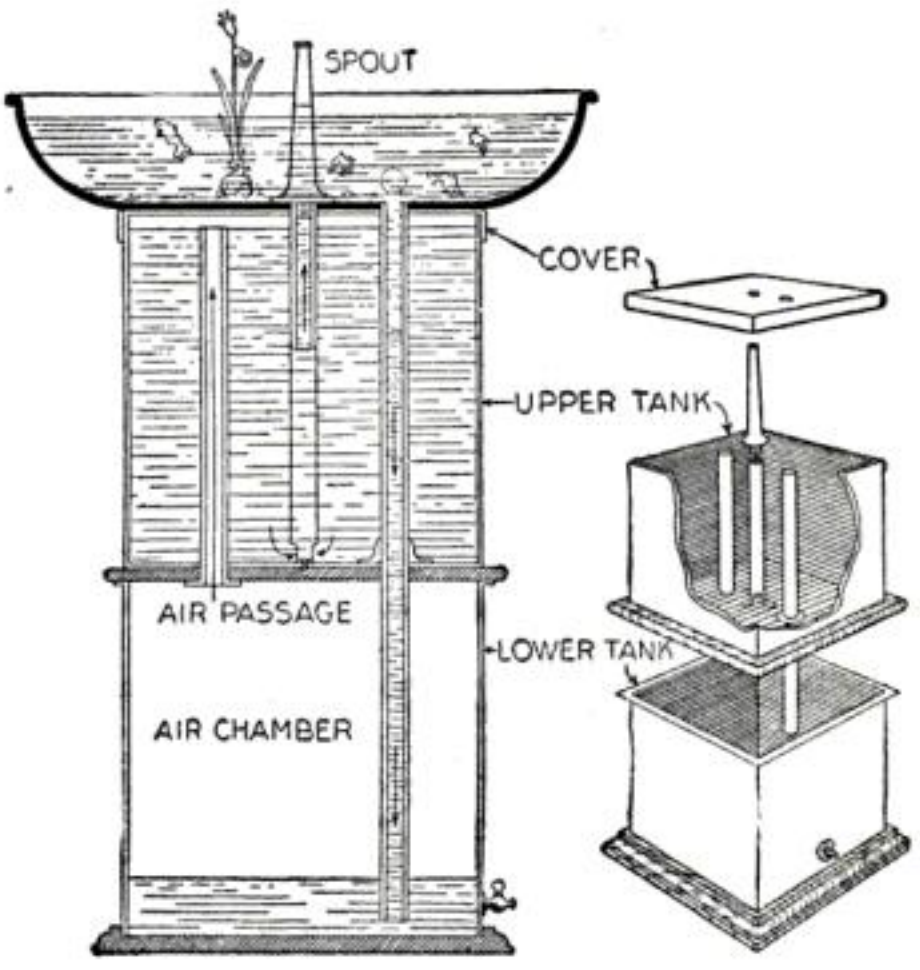
A garden fountain worked by pressure, derived from a weighted piston on water in a near-by cylinder (note dotted lines)

and I do not doubt that a fountain and fish pond which I made will be of interest to others. The basin or pond may be of any depth or diameter. The one shown was a large pan taken from the foot of a glass floral stand, which had a projecting neck in the center. This was removed to make room for the center pipe of the fountain.

With the aid of my lathe I turned a piece of brass tube about 1½ in. in diameter to true its end, and with this, using sand and water as an abrasive and keeping the lathe in motion while holding the pan against the tube with some pressure, the neck was easily cut off leaving a hole in the center the diameter of the tube. Another hole was bored in the same way for the down pipe into the lower tank. The location of this hole was at one side of the center. It may be possible to obtain a basin where it can be bored ready for use.

The stand for the fountain was built of two tanks made of zinc, the bottom one being set in a molded base. This tank is finished on the top with a flange all around and has a small faucet in the side near the bottom. The top tank, which is slightly less in depth than the lower one, is shown fitted to a ¾-in. molded board and has three upright pipes fitted in the positions shown. The left pipe passes through the board and the center one is fastened to the bottom with an inlet at each side, as shown by the arrows. The right pipe passes through and down to within 1 in. of the bottom of the lower tank. All of these pipes are fastened to the bottom of the top tank before the two tanks are connected, after which the cover of the top tank is soldered at the joints.

The center and the right pipe should project through the cover of the tank a distance equal to the thickness of the basin-shell, and these two pipes should also be threaded on the inside, the center one to receive the nozzle of the basin, and the other the plug for starting the fountain. The action of the fountain is as follows: Fill the fish-basin with water, then screw off the upper part of the nozzle and allow the water to run into the top tank until it is filled to within ½ in. of the top. Replace the top part of the nozzle and remove the screw-plug. The water will rush down the pipe on the right side and compress the air in the lower tank, which forces the air up through the pipe into the upper tank, thus compressing and



The weight of the piston compresses the air which forces the water up through the nozzle

forcing the water up through the nozzle into the air.

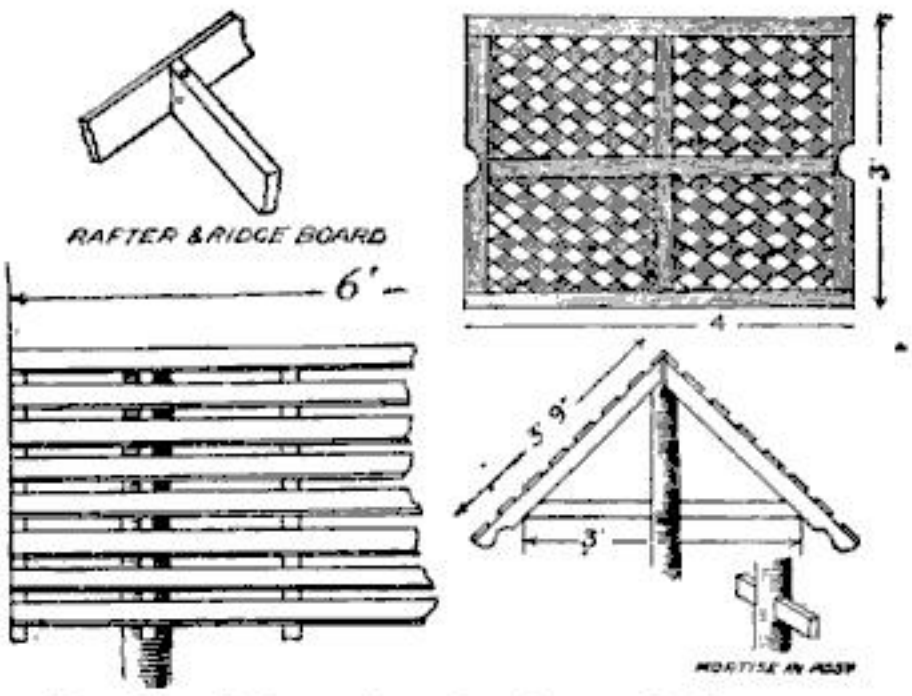
If the fountain is a very small one it need not be fitted with a screw-plug or a faucet.

In such case it is only necessary to fill the lower tank through the pipe having the screw-plug; then by turning the fountain up-side-down the water will run into the other tank. Place the fountain in its proper position and half fill the basin with water, which will rush down the pipe and set the fountain into action. It is not advisable to keep fish in the basin.

A simple garden fountain is shown in the illustration. The pressure tank of this fountain consists of a vertical cylinder about 10 in. high and 6 in. in diameter with a piston heavily weighted. A pipe is connected with a fountain basin having a center nozzle. To start this fountain remove the piston and fill the cylinder with water. Replace the piston and the compressed water will force the fountain to act automatically.—JOHN Y. DUNLOP.

Unique Shelter of Palm Leaf Fans for Garden Entrance

AN owner of a country place desiring to have something different from his neighbors made a garden entrance or shelter along the usual lines, but instead of cover-



Details of the rafter framing and the manner of constructing a latticed ceiling frame

ing it with shingles, prepared roofing or the like, palm leaf fans were nailed on as if they were shingles. These were placed in horizontal rows parallel with the rafters. To construct such a shelter the following materials are required:

2 posts, 11 ft. long and about 6 or 8 in. in diameter.
7 pcs. of 12-ft. stock 2 by 4 in. in size.
35 ft. of sheathing.
A quantity of palm leaf fans. The amount necessary depends on the size of the fans.

The two posts are set about 3 ft. in the ground and tamped in solidly after the upper ends have been cut sloping to fit the pitch of the roof. Two struts or joists are run through mortises cut in the posts 1 ft. 3 in. from their upper ends, or about 6 ft. 9 in. from the ground level. It is best to make this measurement from the upper ends so that the proper measurement will be secured. The other joists are fastened on the same level with pieces across their upper edges for a temporary support until the rafters are in place. The sheathing is firmly fastened with nails.

The finished shelter with its artistic roof of palm leaf fans

The rafters are cut on what is called the half pitch roof, because the height at the center is half the distance of the width. At the top a ridge board is set in between the rafter ends. This board is fastened in place as the rafters are nailed.

The amount of sheathing given in the list is sufficient to allow a space between boards. This mode of construction can be used where a panel is to be set in on the underside of the joist. In case the panel is not used it is best to put on the sheathing without spaces, and with surfaces planed down to produce a finished effect. In the latter instance it will require more boards or about 45 sq. ft.

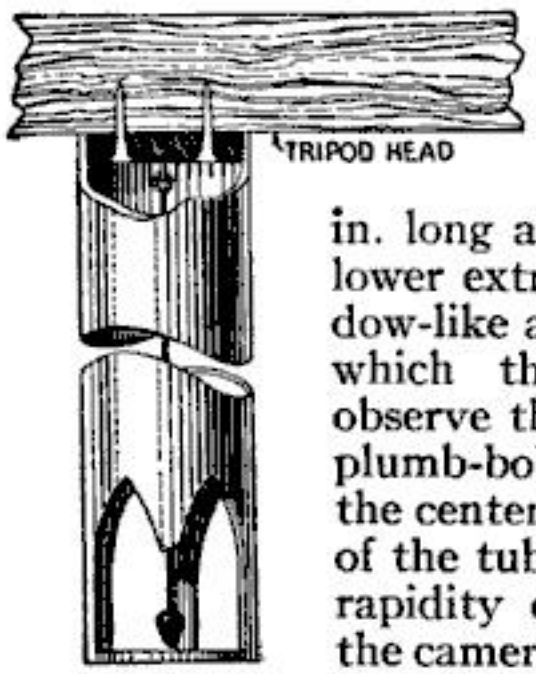
The panel shown in the illustration is another feature of this shelter. It is made of thin material such as is used in the ordinary market basket, and is woven together in basket fashion or like a chair bottom of the old hickory kind. It is then cut into a rectangle as shown and fastened to the upper surfaces of panel boards, when the whole is fastened in place on the underside of the joist with finishing nails.

After applying the palm fans in the same manner as shingles their upper courses on each side of the roof are finished with prepared roofing or ridge boards at the top. This gives a finished effect and covers up a large space that cannot be filled with the fans. The effect of the finished shelter is very artistic.

Leveling a Motion Picture Camera Tripod

THE leveling of a motion picture camera tripod, especially if the panoramic head is used, is very essential. For this,

such cameras are generally equipped with two small spirit levels placed at right angles to one another. These are neither accurate nor easily read. At best the adjustment of two right angle levels on top of three legs is a slow process. The civil engineers recognize this difficulty and make their surveying instruments adjustable to the level positive by means of four screws instead of three. One of the camera men has attached to his tripod-head a very simple leveling device that anyone can adjust without loss of time. It consists of a brass tube rigidly attached to the under side of the tripod-head. The brass tube is about 1½ in. in diameter and 8 in. long and has cut in its lower extremity some window-like apertures through which the operator can observe the position of the plumb-bob hanging from the center of the upper end of the tube. The ease and rapidity of adjustment of the camera to level position by observation of the plumb is self-evident.



Tube enclosing the plumb-bob

To those who care to put such a device on their cameras the following suggestions and illustration may be helpful. The openings at the lower end of the tube should be large enough to permit the operator to see the plumb-bob easily and determine whether or not it is hanging in the center line or axis of the tube. The plumb-bob may be a straight piece of wire hanging freely from a ring support, which must be placed in the exact center of the upper end of the tube; but even if a small plumb-bob terminal is used for the sake of appearance, the support should be a wire so that it will not be likely to foul as would a string or chain if the apparatus should be inverted.—T. B. LAMBERT.

A Substitute for a Shoe Horn in an Emergency

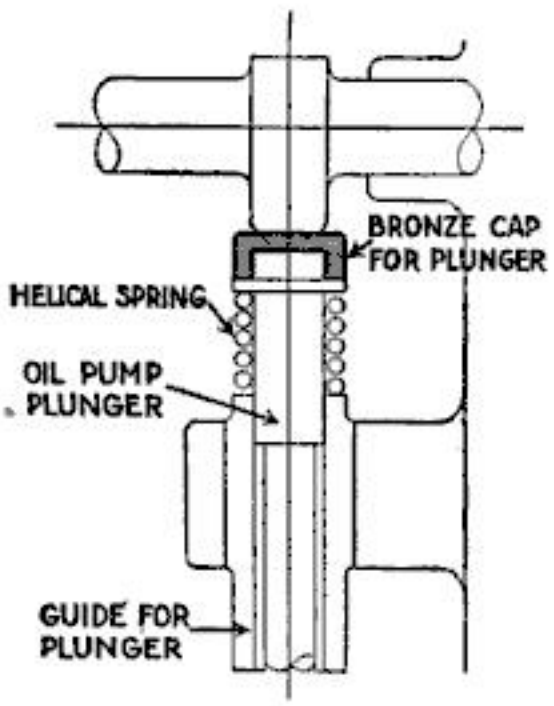
ONCE when I had been in swimming I found myself without a shoe horn, but a friend showed me a little trick that supplied my need. Simply fold your handkerchief two or three times and lay it in the shoe at the heel, holding one end of it. As you press your heel down into the shoe gradually draw on the end of the handkerchief, and when the heel is nearly all the way down draw out the improvised horn. The shoe will slip on the foot easily.—A. A. KELLY.

Preserving Surfaces from Which the Paint Has Worn Off

THERE are sometimes places on the exterior of a house where the paint gets worn off and which cannot be retouched without making a "botch job" of it owing to the difficulty of mixing the new paint to match the adjoining color which has faded. To preserve the wood in such spots until the house can be repainted, apply two coats of linseed oil with a rag. This will improve the appearance also.

Repairing a Worn Plunger in an Automobile Oil-Pump

FREQUENTLY the cause of an engine heating up rapidly can be traced to a faulty oil-pump. This trouble was encountered in one of the cars in our garage and upon examination it was found that the oil-pump plunger was badly worn. This prevented it from delivering the maximum amount of oil to the various bearings. The drawings clearly illustrate the cause of the trouble. The constant rubbing of the hardened cam against the somewhat softer pump-plunger caused the plunger to wear rapidly. This wear decreased the stroke of the plunger.

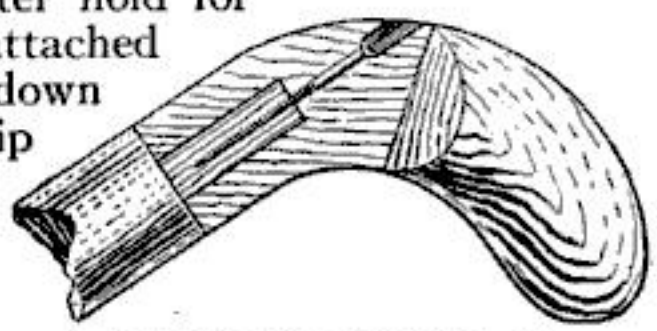


Cap to lengthen worn oil-pump plunger

The repair was effected by providing a bronze cap to the plunger; first to bring the stroke of the pump back to its original dimensions and secondly to provide adjustment against wear. A shoulder was turned at the top part and a small thread cut on it. The cap was made from a cylindrical bar of bronze and was bored out and threaded on the inside to fit the threaded portion on the plunger.—ADOLPH KLINE.

A Turned Down or Pistol Grip Handle for a Garden Rake

THE straight handle on a rake makes it difficult to grasp when drawing it over the ground, especially where the heap of rubbish to be moved is large and long. To make a better hold for the hand I attached the turned down handle or grip as shown in the illustration. A similar grip makes a broken handle on a garden tool as good as new.



A curved grip attached to the end of a rake handle

To apply the grip, cut a shoulder about 3 in. from the end so that the tenon will fit into a hole bored in the prepared grip. The grip is made of a block of hard, even-grained wood, cut to the shape shown. A long wood screw passing through the grip and into the rake handle will make it rigid.—FRANK L. MATTER.

A Tool for Accurately Lining Shop Shafting

IN many shops where machines are belted from lines of shafting little attention is given to the alinement after the shafting has once been lined up unless the settling of the building, the weight of the pulleys and the tension of the belts make it so badly out of line that attention is called to it by the thumping and heating.

Often shafting is so little out of line that it will show no sign of its condition although it will turn so hard that it will require much more power than it should to turn it. The usual test of throwing off all belts and trying the shaft by hand is not always reliable as the strain of the belts may change the alinement, and a section of shafting not perfectly straight may not show by that test, but may cause trouble when run at speed.

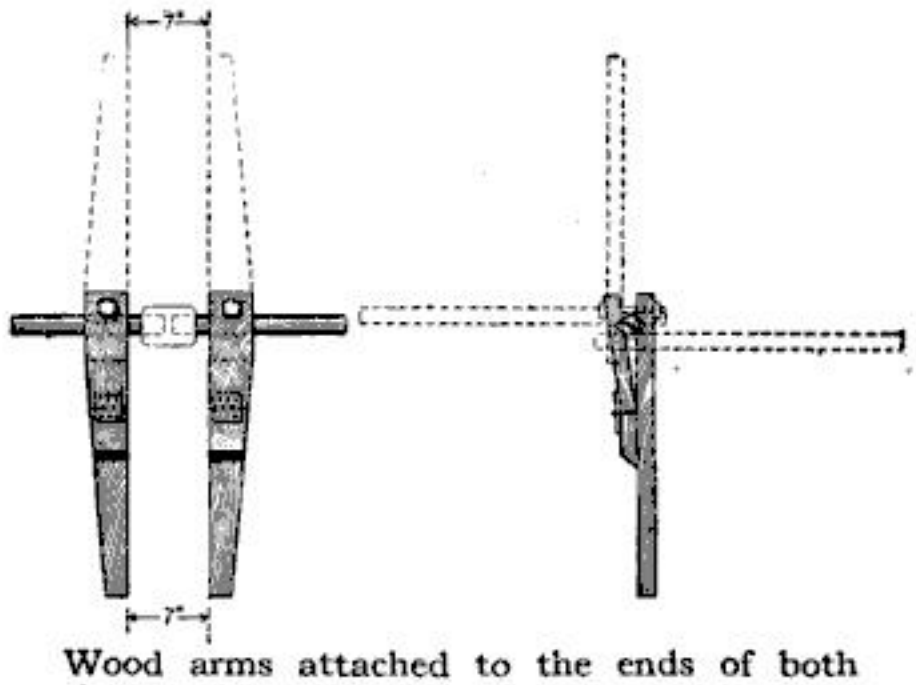
The method described is a certain, practical and economical way of lining new shafting or of testing an old line of doubtful alinement. It can be applied in small spaces between belts and pulleys and will give dependable results of both the vertical and lateral alinement at one setting of the fingers. It is a great advantage to test a line of shafting while it is under the conditions of the tension imposed by its belts and pulleys, as a very tight belt midway between two hangers may spring a section of the shafting. This will cause trouble which may not be detected by any test made with the belt off the pulley.

The method is based upon the fact that when the center lines of two cylinders form a perfectly straight line in their relation to each other, two points, one upon the surface of each of the cylinders, will be exactly the same distance apart when the cylinders are turned.

The fingers fastened as closely as practicable to the ends of adjoining sections of shafting enlarge the diameters of the shafting and make possible the application of this principle with sufficient accuracy to prove whether the two sections of shaft in question are in perfect alinement.

It is evident that the longer the fingers the greater will be the degree of accuracy possible to attain, though in many cases fingers which will permit the shaft to turn completely around will give sufficiently accurate results, as the shaft can be tested both above and below and on each side.

The fingers may be made roughly, for it is immaterial whether they are perfectly square with the shaft or not, as their relation will be the same if each is firmly fastened upon the shafting. They may be held in place by a clamp or by a bolt as



Wood arms attached to the ends of both shafts to determine the accuracy of the lining

indicated by the sketch. Care is necessary in measuring the distance between the fingers in their different positions, and in adjusting the shafting so the distance will be exactly the same in whatever position the measurement is taken.

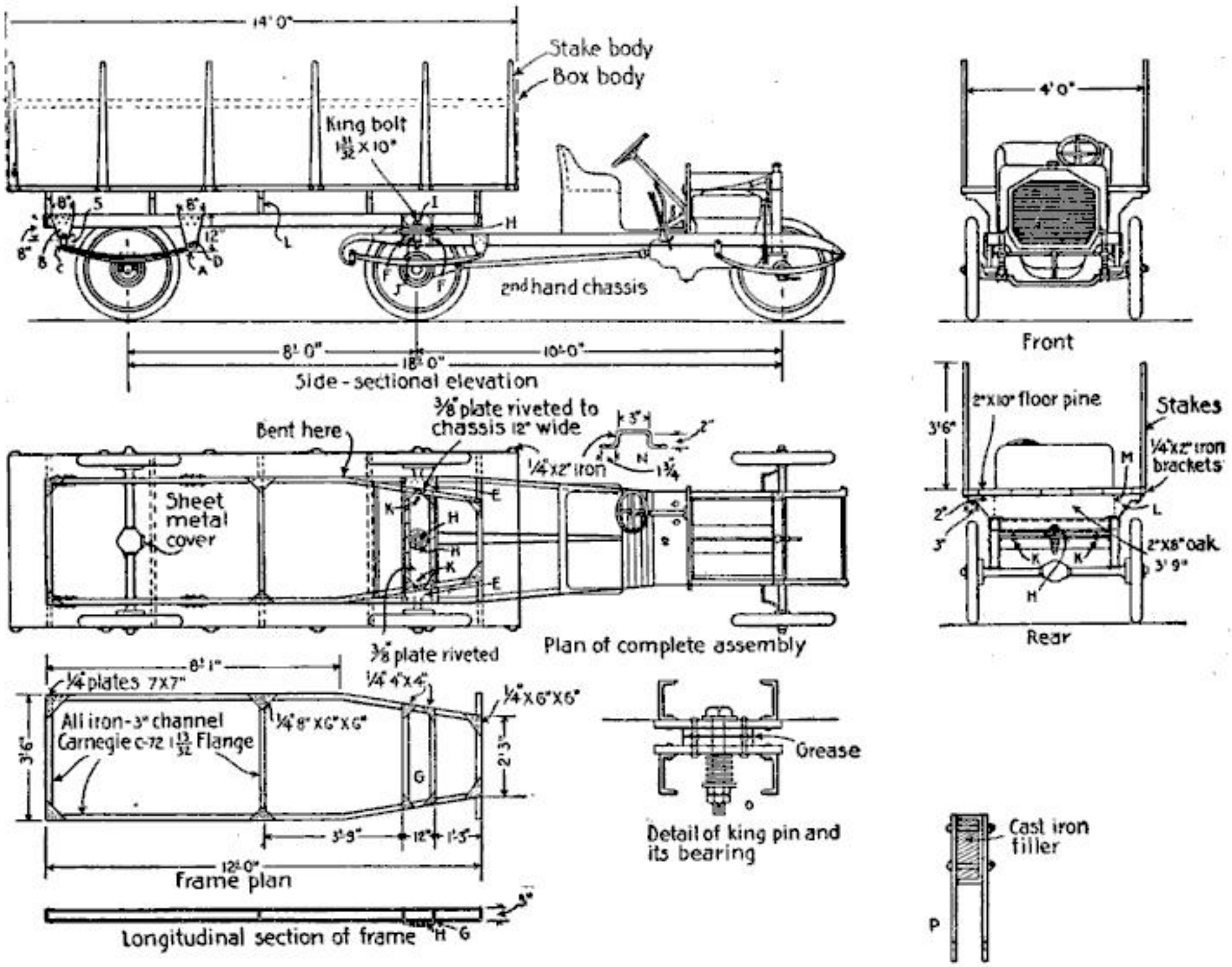
In lining a new shaft by this method several pairs of fingers may be used at once to save changing, in which case the middle section should be correctly lined and the rest of the shafting lined both ways from it.—CHARLES A. KING.

A Tractor Trailer Made from an Old Automobile

AN old automobile having good mechanical parts, but too out of date in appearance to be used as a pleasure car, may be utilized as a truck by attaching a trailer. The illustrations and description are for changing over and attaching a trailer to a 35 hp. automobile having a 4-cylinder engine with a three-speed forward and a reverse. The wheel base of the one used was about 128 in. The original body on the automobile was of the touring type. To make use of as much of the body as possible it was cut in two just back of the front seat and the rear part removed to make free use of the frame for the fifth wheel of the trailer.

Two pieces of channel iron were then cut and riveted in the frame directly over the rear axle. These pieces support a plate on which the bottom part of the fifth wheel rests, a hole being drilled through both for a king pin. This is clearly shown in the detail drawing.

An entire rear axle for an automobile with springs and tires was procured. All brake connections were removed and the number of spring leaves increased. These were refastened to the axle in their original position with longer spring clips. Four pieces each were made of *A*, *B* and *C*, of the dimensions given, from ⅜-in. steel. These pieces made the spring suspension



Details of the fifth wheel to attach to the rear part of a pleasure car frame, after the body has been removed, to make a trailer truck. Details are also given for its frame and body construction

bracket *A*, the rear suspension brackets *B* and the spring shackles *C*. These pieces were cut from scrap at a structural shop and ¾-in. holes were punched for rivets and ⅝-in. holes drilled for the spring pins *D*. In fastening the pieces *A* and *B* to the frame it is much better to make a cardboard or paper pattern and carefully center-punch and drill the holes. Securely bolt the pieces, using a cast iron filler as shown in the detail. The filler may be of any suitable piece of scrap iron that will fit into the channel. The projecting ends of

the bolt ends from the nuts was riveted over. Ordinary rivets can be used in place of the bolts, if they are put in hot.

The trailer frame was made of 3 by 1 13/16-in. channel iron with cross-pieces riveted in place, corner braces at each end and corner plates. The plate *E* is 12 in. wide and ⅜ in. thick, and as long as the trailer chassis is wide. It is securely riveted to the frame and cross-member *F*. The plate *G* is 12 in. wide, cut to shape from ⅜-in. stock. Two circular plates *H*, 2¾ in. in diameter, were cut out and fastened in the center of each upper (*G*) and lower (*E*) plates. A 2-in. hole was then drilled through the center of both circular plates and the plates *G* and *E* for the king pin or bolt *I*, which was made of 1 31/32-in. stock with a 1½ by 3-in. head, and a steel washer 3½ by ¼-in. under the head. This bolt is 10 in. long with a 4-in. length of threads. A spiral spring *J* was placed on the end of the bolt under the washer where it was secured under light tension with a nut, locknut and cotter.

A groove was cut in each of the plates *H* for a grease retainer. Two holes were drilled in the plate *G* for two ⅞-in. bolts to serve as bumpers for any side thrust that might be made.

The floor of the trailer was placed on five pieces *L* cut from 2 by 8-in. oak. These were fastened with long bolts *M*, as shown. The opening left in the front part of the housing for the differential was covered with a plate bolted in place. The detail *N* is for irons to hold the stakes, *O* is for the king bolt and *P* for the bracket connections.

Inflation and Weight Governs the Resiliency of Tires

RESILIENCY of the tires is primarily governed by the construction and quality, but is largely influenced by the inflation and weight carried. Naturally a 4-in. tire inflated to 70 lb. air pressure and carrying 800 lb. weight will ride easier than the same size tire with the same inflation, and carrying 700 lb. weight. The heavier weight causes more deflection of the tires on the ground and increases the action of the side walls, thereby adding to the comfort of the ride. Increasing the deflection or flattening of tires, either by extra weight or reducing the air pressure, causes more of the vibration to be absorbed by the tires than by the springs of the car.

A Cement Wash to Be Applied to a Damp Wall

A GOOD cement wash for a damp wall may be made with 7 parts of soft, clear water, 1 pint of lime water and 2 oz. of table salt. Stir the cement enough to form a paint, adding any earth color desired, or use plain.

A Porch Swing Made from Your Favorite Rocking-Chair

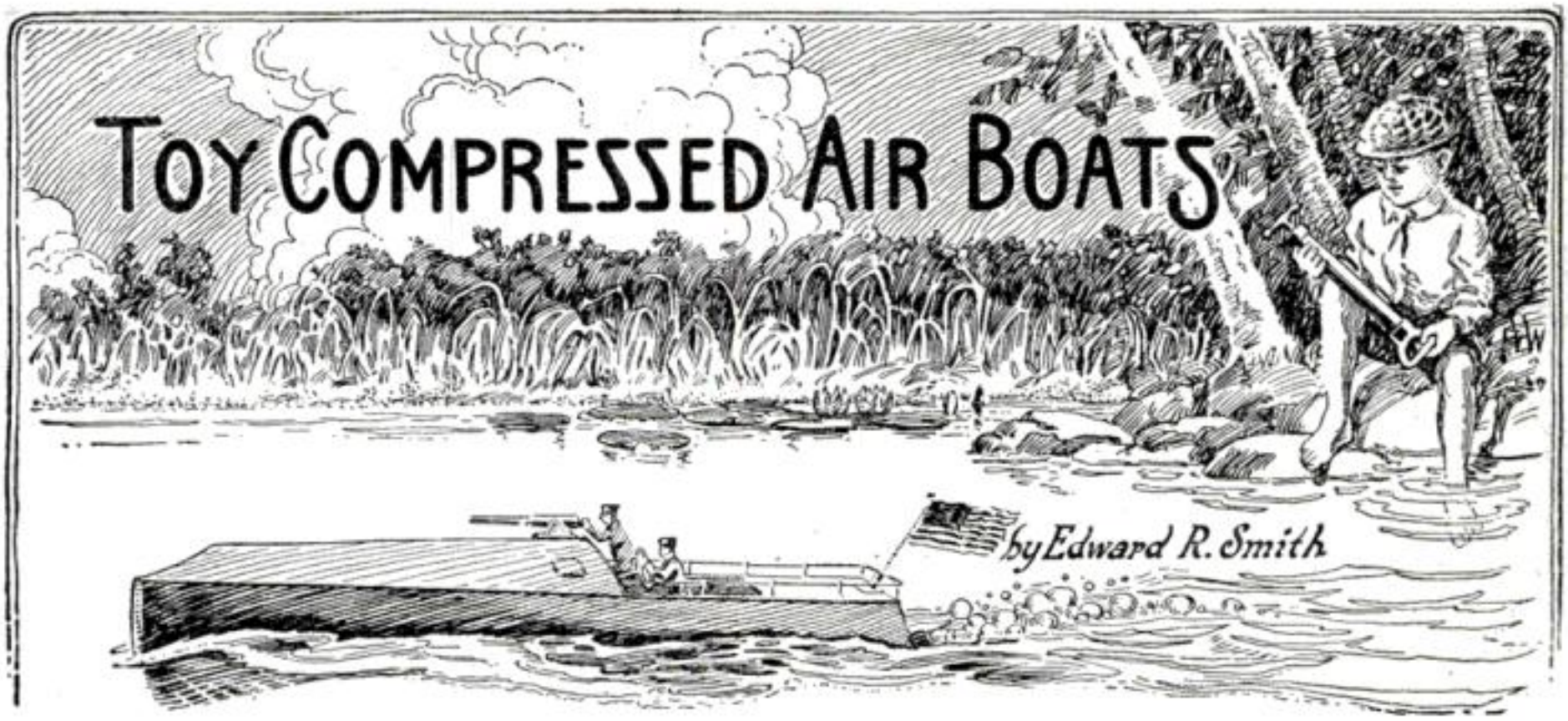
A COMFORTABLE rocker can be converted into a swing without altering or defacing the chair. The materials needed are two strips of wood about 1¼ by 1½ in. and about 8 in. longer than the width of the chair seat; two sets of hammock chains; six stout screw-eyes and four long, slim wood screws.

The strips are fastened with screws to the under part of the seat frame. The chains are suspended from two screw-eyes set in a joist in the porch ceiling and are hooked into screw-eyes set near the ends of the two cross-pieces.

Auxiliary frame under seat of a rocking-chair for fastening the ends of the chains

When the swing season is over, these attachments may be easily removed and neither the chair nor the porch will be any the worse for the out-of-doors usage of the chair.—T. H. LINTHICUM.

TOY COMPRESSED AIR BOATS



by Edward R. Smith

A SHIP has recently been devised which carries a veritable gale pent up, not in an oxskin, such as Homer's Odysseus used to carry away the winds from the isle of Æolus, but in a cylindrical tank. This boat was designed primarily as a toy, a bicycle pump being used to fill the tank. With one pumping, 16-in. models have a cruising radius of about 100 yd. and run from ½ to 10 minutes, depending upon the rate of escapement of the air.

In the course of experiments with air propulsion it was found that a simple jet of air, allowed to escape from a boat, is very ineffective. Placed in a semi-circular tunnel the jet becomes doubly efficient. Still greater saving of power is made by leading the spent bubbles up in an incline at the stern to the surface, as shown in Fig. 1. Thus the lifting power of the bubbles is used in propelling the boat, or it might be said that the boat is continually coasting down a row of bubble rollers.

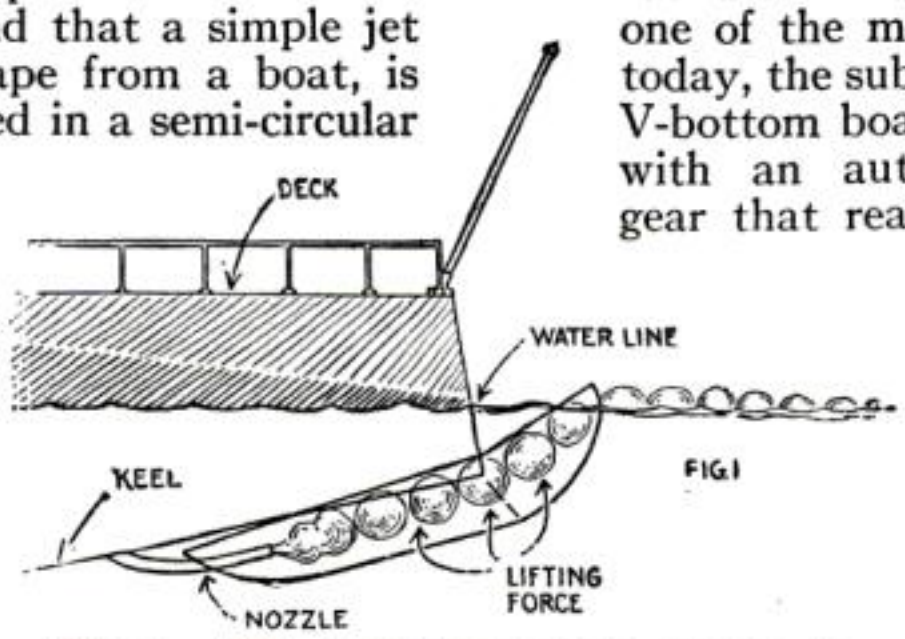


Fig. 1. The compressed air is allowed to escape in a semi-circular tunnel at the stern

Making an Air Torpedo

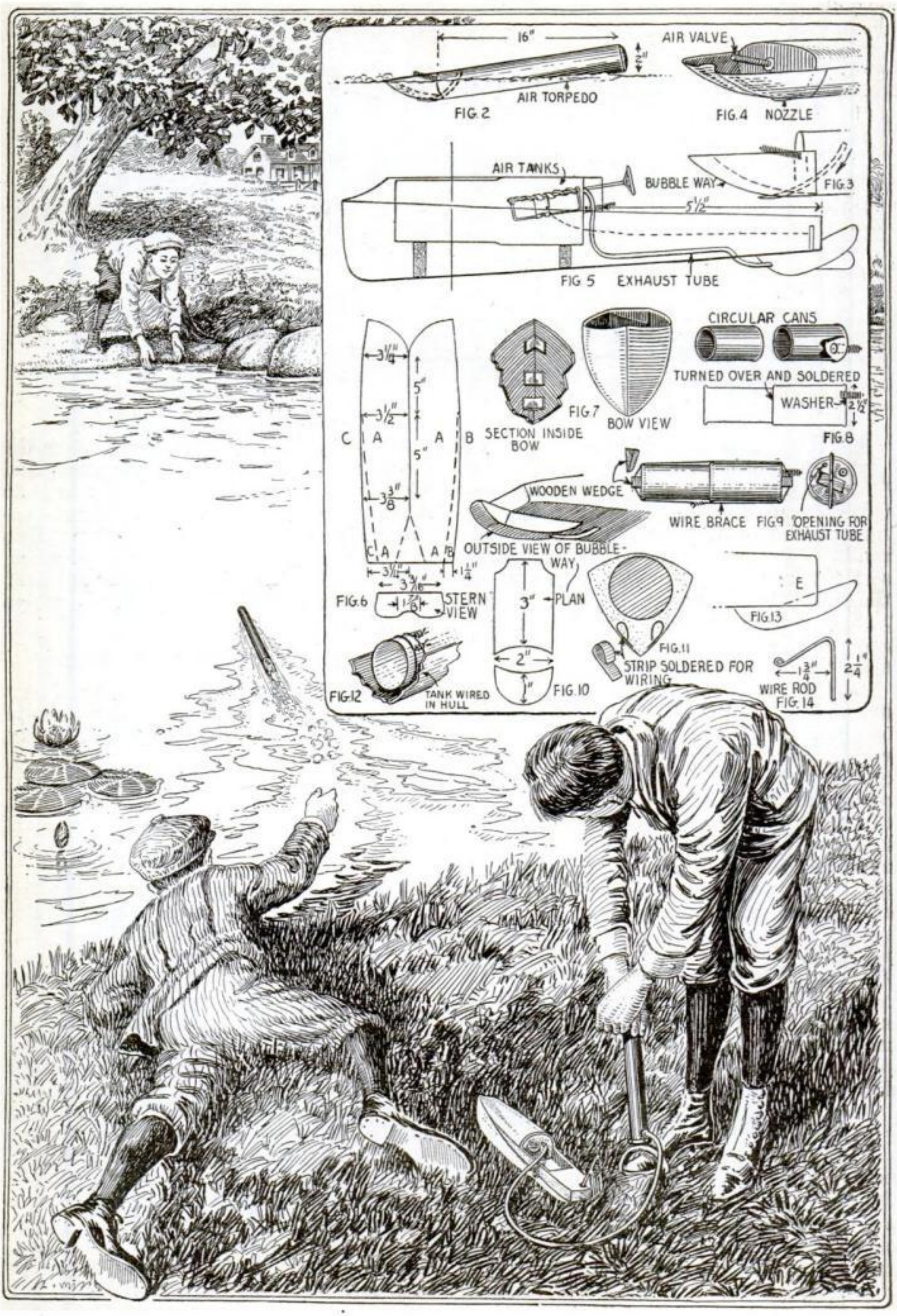
Perhaps the most simple form of an air boat, as a toy or for experimental work, is the torpedo, in which an air chamber forms a greater part of the boat-body. This air chamber, as shown in Fig. 2, is a 2-in. cylinder with semi-spherical ends, into one of which a bicycle tire air-valve is fitted. To this end a stern piece, containing a bubble-way, Fig. 3, is soldered. With the air-pipe and nozzle, Fig. 4, in place, and with the tank tested airtight, the torpedo is ready for use. The speed depends entirely on the size of the jet aperture. This can best be regulated with a pair of pliers. Since speed is desired, it should be adjusted to exhaust the air supply in 20 to 30 seconds.

How to Make a Submarine Chaser

In the illustration, Fig. 5, there is shown one of the most interesting toys of today, the submarine chaser. It is a V-bottom boat, all metal, war gray, with an automobile-type steering gear that really moves the rudder. It is 16 in. over all, with a 4½-in. beam, and runs from 5 to 12 minutes at a fair speed. Any boy who has a soldering set and tinsnips can build it at small expense.

The hull with the extension of the stern-plate is cut from a single piece of sheet tin, Fig. 6. This metal is bent on the lines *A*, *B*, and *C* to form the keel and sides. With three angle strips to reinforce it, the bow is soldered together as in Fig. 7. The stern-plate is next fitted on. Now it is ready for the tank. This is made of two circular cans, in the larger of which an air-valve is placed before the two are joined, to form a cylinder 8 in. long and 2½ in. in diameter. This is shown in Fig. 8. The ends of the tank are strengthened by a wire

Speeding a Torpedo with Air from a Bicycle Pump

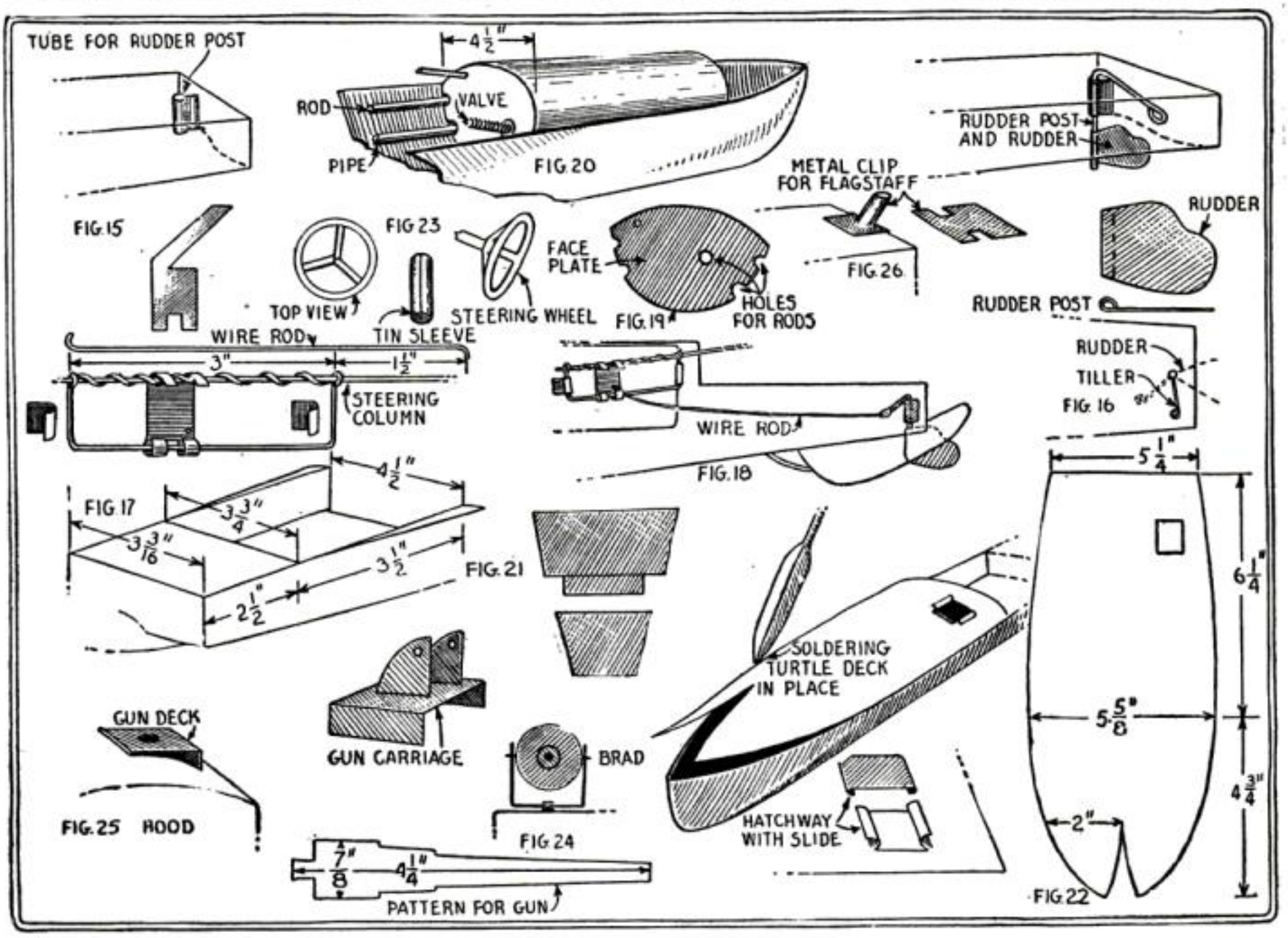


brace and wood wedges, Fig. 9. Through a hole in the keel, Fig. 5, a 3/16-in. pipe is led from the top of the tank to a brass nozzle. The bubble-way, Fig. 10, is then fastened in place and the strips *D*, Fig. 11, for the tank wires, are fixed to the bottom. At this point the tank may be wired or strapped in, Fig. 12, and the exhaust pipe soldered in the keel. If desired, a preliminary test may be made for adjusting the speed of the boat.

If these trials are satisfactory, the steering gear and rudder are put in. A hole *E*, Fig. 13, is punched through the bubble-way and hull to take the rudder post, Fig. 14, made of heavy wire. This post, to prevent leaking, works in a tube, Fig. 15. With the tube soldered in, the rudder, Fig. 16, may be fastened to its post. The steering column, Fig. 17, is made and soldered to the side of the air cylinder and connected with the rudder post by a wire rod, Fig. 18.

The boat is now ready for the superstructure or casing. First the face plate, Fig. 19, with holes for the steering column, air-valve, and rudder-rod, is fitted in, Fig. 20; then the main and after decks, Fig. 21, the edges of which are turned up with a file. The hood or turtle deck, containing a hatchway to make the steering accessible, is roughly cut out. Beginning amidships, the hood is bent over the tank and soldered along the sides, Fig. 22, the tin being trimmed down to fit the hull. The steering wheel is made from a circle or wire soldered to three wire spokes which in turn are fastened to a tin sleeve, Fig. 23. This slips into the steering column.

A gun deck may be added, Fig. 24, and a turned wood or metal gun mounted on it, Fig. 25. A metal clip, Fig. 26, is soldered to the afterdeck to take a flag. With a coat of enamel the chaser is complete.



Patterns for making the hull of a boat that represents a submarine chaser, the parts being designed so that a storage tank is placed in the fore part under a turtle deck for supplying the air pressure

In general it is better to make cardboard patterns of the hull and superstructure parts before attempting to cut out the tin. It is well to see that the rod connecting the steering column and rudder also works freely before soldering it to the deck. The several dimensions given are merely suggestive. The casing should be fitted to the hull; for your tank, steering gear or some minor detail may differ a bit from the specifications given in the illustrations.

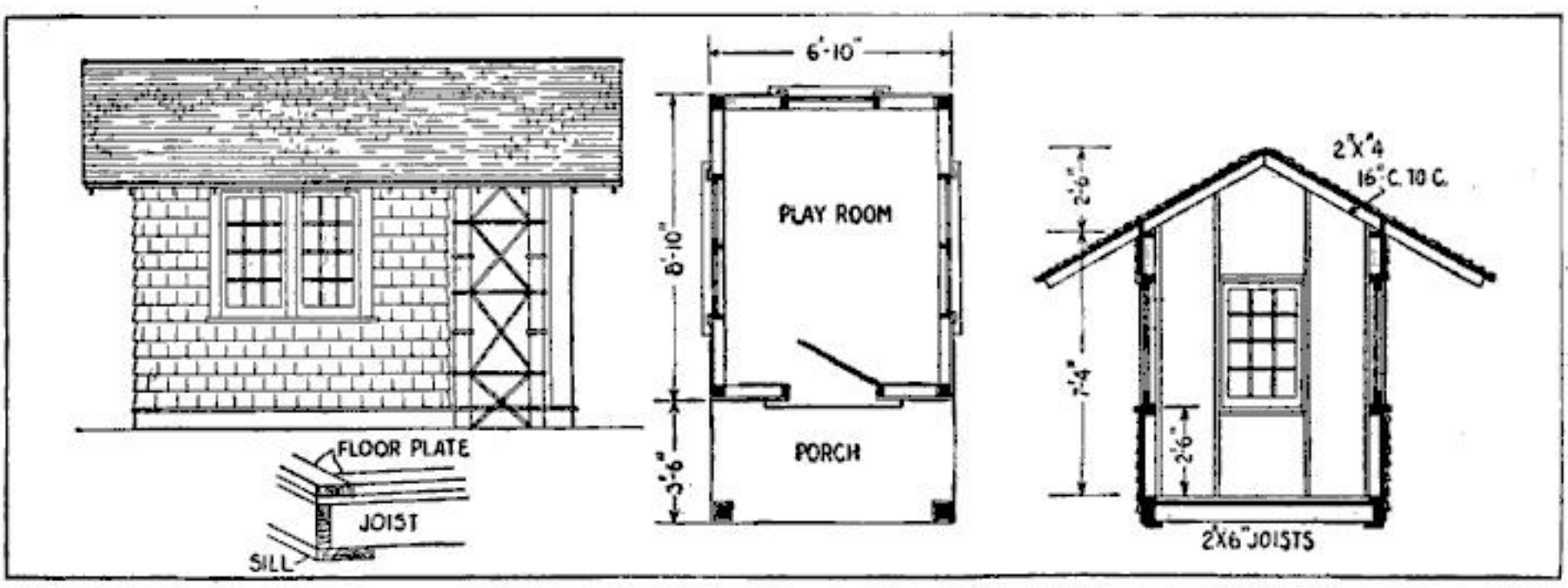
Making a Durable Playhouse for the Children

THIS is really a young contractor's job, and the boy building it will have something to be proud of. When complete as shown it makes an ideal playhouse for the children. The manner of construction is that employed for any house with the exception that it is not plastered or lined in any way, the studs and rafters being exposed. As window and outdoor frames, the door and window sash can be purchased, the actual building is not very difficult. The sills are built up of 2 by 6-in. material, as shown in the detail. The studdings are 7 ft. 4 in. long. A plate is placed on top for the rafters. There will be required 12 pairs of rafters 7½ ft. long.

The location should be level and stone or brick piers should be built up a short distance for keeping the sills from the ground. The porch is a mere extension of the floor within. Both are built up in one piece. The floor plate is then run across 3½ ft. from one end or the line of the house end. The roof extends over the same as the floor. The following is the list of materials needed:

400 ft. of 2 by 4-in. studding and rafter material.
100 ft. of 4-in. flooring.
605 ft. of shiplap sheathing.
30 lineal feet of 8-in. and
30 lineal feet of 6-in. finish lumber.
160 lineal feet of 2-in. strips for the lattice on porch.
130 lineal feet of 2 by 6-in. dimension stock for joists and sills.
8 bunches of shingles.
2 double frames for side windows.
1 single frame for the end window.
1 door frame.
5 window sash.
1 door.
hardware.

The setting of the door is no difficult task as the hinges are gained in and the lock attached in the usual way. The window sash may be put in like the ordinary kind or swung on hinges like a casement window. The lattice may be arranged as shown or in any manner to suit the personal tastes of the builder.—W. E. FRUDDEN.



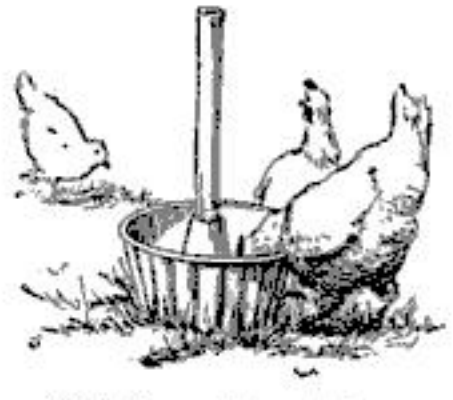
Elevation and plan view of a children's playhouse that is so simple in design that any intelligent boy with a talent for carpentry can begin his contractor's career by building it for his sister

Mixing a Durable Water Color Aluminum Paint

TO make a water color aluminum paint dissolve some gum shellac in borax water strong enough to dissolve the shellac, adding enough bronze powder to make the paint. Add a little aniline for color, if color is desired, or the plain bronze, using a very little glycerine to make the paint more flexible. This paint is bright, durable, and waterproof.

An Old Cake Tin Makes a Good Watering Pan for the Poultry Yard

A CHEAP and satisfactory watering pan for the poultry yard can be made of an ordinary funnel cake pan. Secure the pan to the ground by driving a stake through the funnel hole and into the earth. It is easily changed to any desirable spot, cannot be tipped over and will serve a dozen or more chicks at one time without danger of hurting them.—JENNIE MCCOY.



Holding stake driven through hole in pan

Sheet Metal Working Simply Explained

III.—One-piece pattern for making a twenty-sided steeple ornament

By Arthur F. Payne

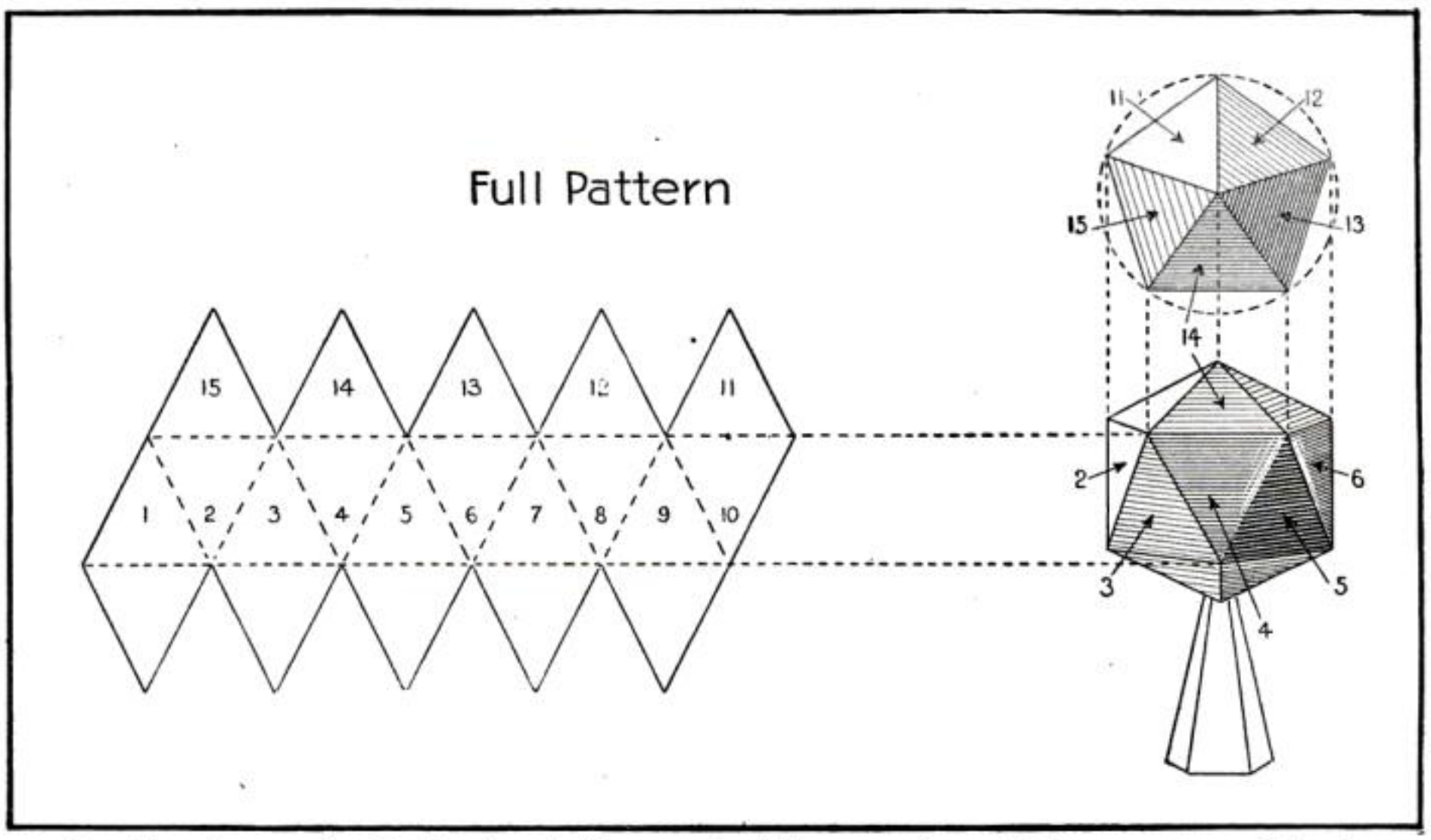
Assistant Professor Manual Arts, Bradley Polytechnical Institute

THE problem for the development of a pattern for a twenty-sided finial is very interesting. Glancing at the drawing of the finial it will appear difficult to lay out a one-piece pattern of tin in such a manner that when it is bent up it will take the shape shown in the finished drawing, but if the drawing is given close attention and study it will be readily seen that all of the twenty faces are of the same size and shape, and that each face is an equilateral triangle; that is, a triangle having three sides the same length.

It is necessary to get first a true pattern of one of these faces. The No. 4 face is the only one that is lying flat on the paper, all the others are apparently receding from the surface of the paper. When a face is lying flat on the paper, as this one mentioned, it is called "lying in the plane" of the paper. All such faces are true patterns.

To lay out a pattern for such a finial it is necessary to know first how large the finial is to be when finished. For convenience of this problem we will consider one 10 in. in diameter at the widest part. The steps taken in order are as follows: (1) Draw a circle 10 in. in diameter—see dotted circle in upper view. (2) Divide circle into five equal parts and connect these points with straight lines. (3) Project one of these lines down for the top line of the triangle 4 of the front view. (4) With a pair of compasses and a ruler draw the triangle 4 with all sides equal in length. This is the true pattern for one face. (5) Draw this pattern as No. 4 face in the "full pattern" and then draw the other faces exactly as shown in the full pattern.

Cut the pattern out of tin and proceed to bend on the dotted lines. It will be necessary to bend the top and bottom row



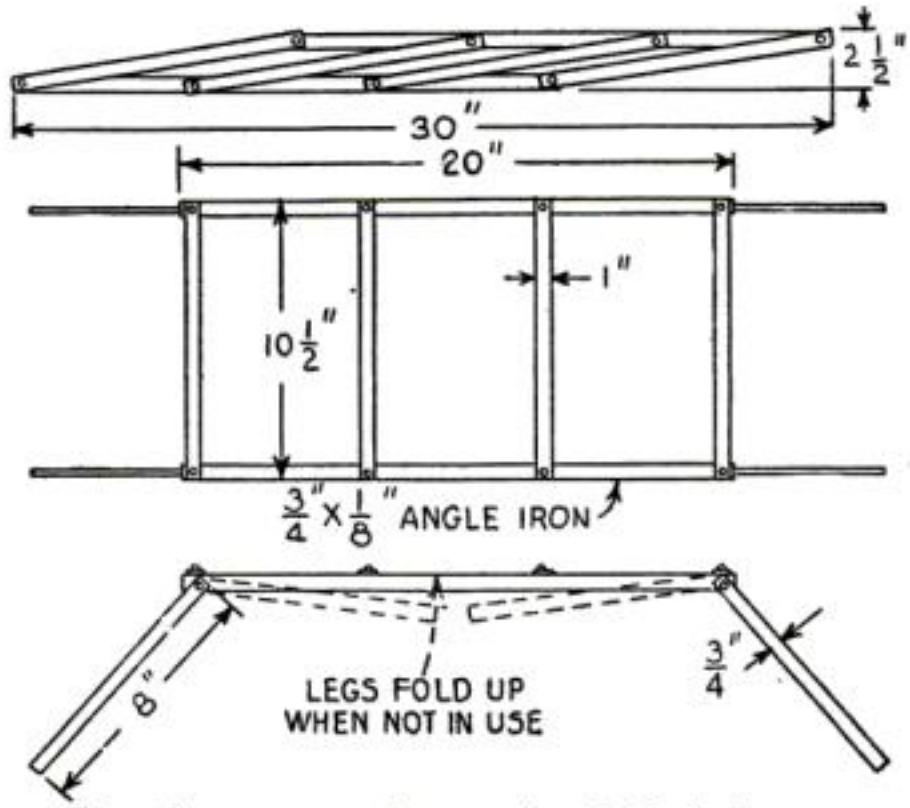
A pattern in one piece having twenty faces, each of the same size and shape, or an equilateral triangle, to make a twenty-sided finial to be shaped from sheet metal for a steeple ornament

of triangles at an angle of 120 deg. The center row of triangles should be bent at an angle of 72 deg. The bending may be done by means of a "brake," or over a "hatchet stake" with a mallet.

The beginner, learning the trade, will be interested to know the scientific name for such a finial. In solid geometry it is one of a group of forms called "polyhedrons," meaning many sided solids. The word "poly" means many. A cube is a polyhedron that has six equal faces and its special name is a "hexahedron." A solid with eight faces is an "octahedron." This finial, the pattern of which is developed, is called an "icosahedron," because it has twenty faces.

Folding Camp Fireplace Made of Angle Iron

ANY one who likes to go camping will be interested in these stoves. The only tools needed to make them are a hacksaw, riveting hammer and a breast drill with a 3/16-in. bit. The sides are made of two pieces of angle iron ¾ by ⅛ in. The ones used in making the fireplace illustrated were taken from an old bedstead. The legs are ¾ by 3/16-in. flat iron and the bars across the top are from flat galvanized steel 1 by 3/16 in. This is used to hold the sheets of galvanized iron together. These sheets may be obtained at any tinsmith's shop at a small price. One advantage of this style



The frame may be easily folded flat so that it can be put away in a narrow place

of grid or fireplace is that it folds up compactly and is steady when set up. It also has the great advantage of being adjustable as to width. The fireplace folds into a narrower but longer space than when open. I have found it extremely useful as a stand for an ordinary camp stove when used in a tent; for when it is opened to its full extent it just fits a small iron stove.—B. E. DOBREE.

Garden Seat with Checkerboard in Its Top

GARDEN seats of the ordinary bench type can be made to serve a twofold duty by placing in the center of their upper surfaces a checkerboard design. In the

The checkerboard on the garden seat makes checkers an inviting outdoor game

wood top, squares may be cut out with a chisel or knife and alternate ones painted black. The checkermen can be kept in a small drawer placed under the seat.

If a cement seat is made along these lines, black and white square tiles can be set in the cement to form the checkerboard design. In making the seat of cement, places must be provided for screws or expanding bolts which must be inserted on the underside at the center for holding the drawer slides.—EDWARD R. SMITH.

Constituency of Rubber for Side Walls of a Tire

THE side walls of a tire must be flexible in order to properly distribute the strains, give resiliency, minimize heat, prevent sharp bending of the fabric, breaking and separation. Therefore, it is desirable that the rubber on side walls of a tire be elastic and not too dense or firm; the kind of hard wear resisting rubber used on the tread is not suitable for covering the side walls. The difference in materials and adaptability for tires may be compared with automobile and machinery parts—some materials are required to possess great strength and some are selected for other qualities, according to their tasks.

Manufacturing Prussian Blue from American Products

THE shortage of many colors and dyestuffs in the United States since the European war has caused a thorough investigation into the means available for the direct manufacture of Prussian blue, which has been and still is in great demand for the production of printers' ink, dyeing, wall-paper printing, oil color and in compounding colors for many other uses where an intense blue is required. Prussian blue, or cyanide of iron, has hitherto been produced mainly from the potassium salts, such as the cyanide and ferro-cyanide, and known in trade as soluble Prussian blue represented by the symbols $KFE_2 (CN)_6$, while the insoluble blue is represented by $FE_7 (CN)_{18}$ and $FE_5 (CN)_{12}$.

The great demand for this blue coupled with the increasing scarcity of it has caused the price to rise considerably. The production of this valuable color from the potassium salts is out of the question in the United States. This is because the supply of salts from the European market has ceased, and those obtainable are too costly. However, cyanide blue can be made at a very moderate cost from the following materials to be procured in the United States: Sulphuric acid, 66 deg., nitric acid, 38 or 42 deg., proto-sulphate of iron (common copperas) and a product known as cyanide mixture, which consists of a combination of cyanide of sodium, and chloride of sodium, which will yield from 39.2 to 40 per cent of cyanogen. The sulphuric acid and nitric acid are of the commercial variety, not necessarily chemically pure.

A number of wine barrels will be required of a capacity of 50 or 60 gal. each, which have been dried and thoroughly coated on the inside with very hot, hard paraffin. The barrels are for use in producing and holding a saturated solution of proto-sulphate of iron called the copperas solution, which is made by impending about 100 lb. of the iron salt in small sacks attached by nailing to a simple wood frame made so that the ends of the frame rest upon the top of the barrel. The sack or bag when suspended should occupy about two-thirds the depth of the interior. By this means the sack hangs in the water and must not occupy more than three-quarters of the space within, because the constant dissolving of the iron salt will gradually fill the barrel. As the salt dissolves, a quantity of dirt will be held in the sack while a completely saturated solution will occupy the lower portion of the barrel. The barrel should be provided with a wood stop cock well soaked in hot paraffin placed about 6 in. from the bottom. This will allow for the saturated solution to be drawn off clear and free from dirt. The sacks or bags must be kept full to the brim

A sack or bag to hold the iron salt is hung from a square frame in a barrel

with the iron salt, which is readily accomplished by the use of an iron pail. The cyanide solution must also be prepared for use by employing a clean sack in a barrel of water the same as for the iron salt. In this case about 157 lb. of the cyanide mixture will give 50 gal. of a saturated solution, approximately, much depending on the temperature.

The concentrated solution of cyanide should register on the hydrometer 100 grains to the ounce of water. A Baume hydrometer will be required to test the iron solution, which should register 30 or 31 when ready for use. This will be equal to about 100 or 110 grains of iron salt to each ounce of water. Several large stoneware crocks will be required of a capacity from 30 to 50 gal. in which the saturated solution of iron salt is oxidized under heat and acid. This is carried out in the following manner:

Oxidizing the Iron Solution

Place 30 gal. of the saturated solution into a 50-gal. crock and pour into it 6 pints of sulphuric acid, 66 deg. Stir the mixture well and heat it with steam, using a pressure

of 60 lb. to the square inch. This is done by inserting a ⅜-in. iron pipe in the solution, allowing the end to go within 6 in. of the bottom. In the course of 10 minutes this will bring the solution to the boiling point, when the steam must be turned off and the pipe removed.

The next operation is the adding of 8 or 9 pints of nitric acid, specific gravity, 1.38 or 1.42, known as 38 or 42. This must be added slowly to the hot mixture while a second person keeps it stirred with a long

The mixture is well stirred while heat is applied by steam through an iron pipe

strip of hardwood. During this operation dense red fumes of nitrous acid will be evolved and the mixture will boil vigorously. As soon as this amount of acid has been added, the solution must be allowed time for cooling, which will require from 14 to 16 hours, when it will be found that the quantity has increased from 30 to 35 gal. This is due to the condensing steam and the addition of the acids.

Preparing the Cyanide Blue

Place 30 gal. of the cold iron mixture into a tub or stoneware vessel that will hold 50 or 60 gal. and add 10 gal. of cold water. Draw off 8 gal. of the cyanide concentrated solution, add 2 gal. of water and pour it all into the iron solution while stirring the mixture vigorously. Avoid breathing the fumes that may be given off, because they consist of diluted cyanogen gas. Fill the vessel with cold water, cover it and allow it to stand for 24 hours. Upon the addition of the cyanide solution a dense and voluminous precipitation of Prussian blue will take place. As soon as the blue has become settled at the bottom, the clear liquid must be drawn off with a siphon made of plain iron pipe, care being taken not to permit the blue to be drawn off. This liquid, which still contains a fair proportion of a free salt of iron, may be placed in a suitable vessel for further precipitation. As soon as the liquid has been drawn off, the tub must be refilled with clear cold water, stirred well and allowed to stand for 12 hours, when the liquid may be drawn off as before and thrown away. About six such washings will be required to free the blue from the several soluble impurities. After drawing off the last washing water the precipitant is scooped up and poured into an unbleached muslin bag, which is suspended in a clean barrel in the same way as employed for the iron and cyanide solutions. The remaining blue is washed out of the tub or crock, placed in the muslin bag and allowed to drain for 24 hours. At the end of this time the contents of the bag must be spread out upon muslin in suitable trays. These should be 3 ft. long, 2 ft. wide and 4 in. deep. When filled they are placed in a drying room like drawers in a file where steam may be applied for heating it to a high temperature. The room should be well ventilated so that a current of air coming in at the bottom will pass out at the top after circulating about the trays. This will evaporate the moisture left in the blue. As soon as it has dried thoroughly it may be ground to a powder in any suitable mill and it is then ready for the market.

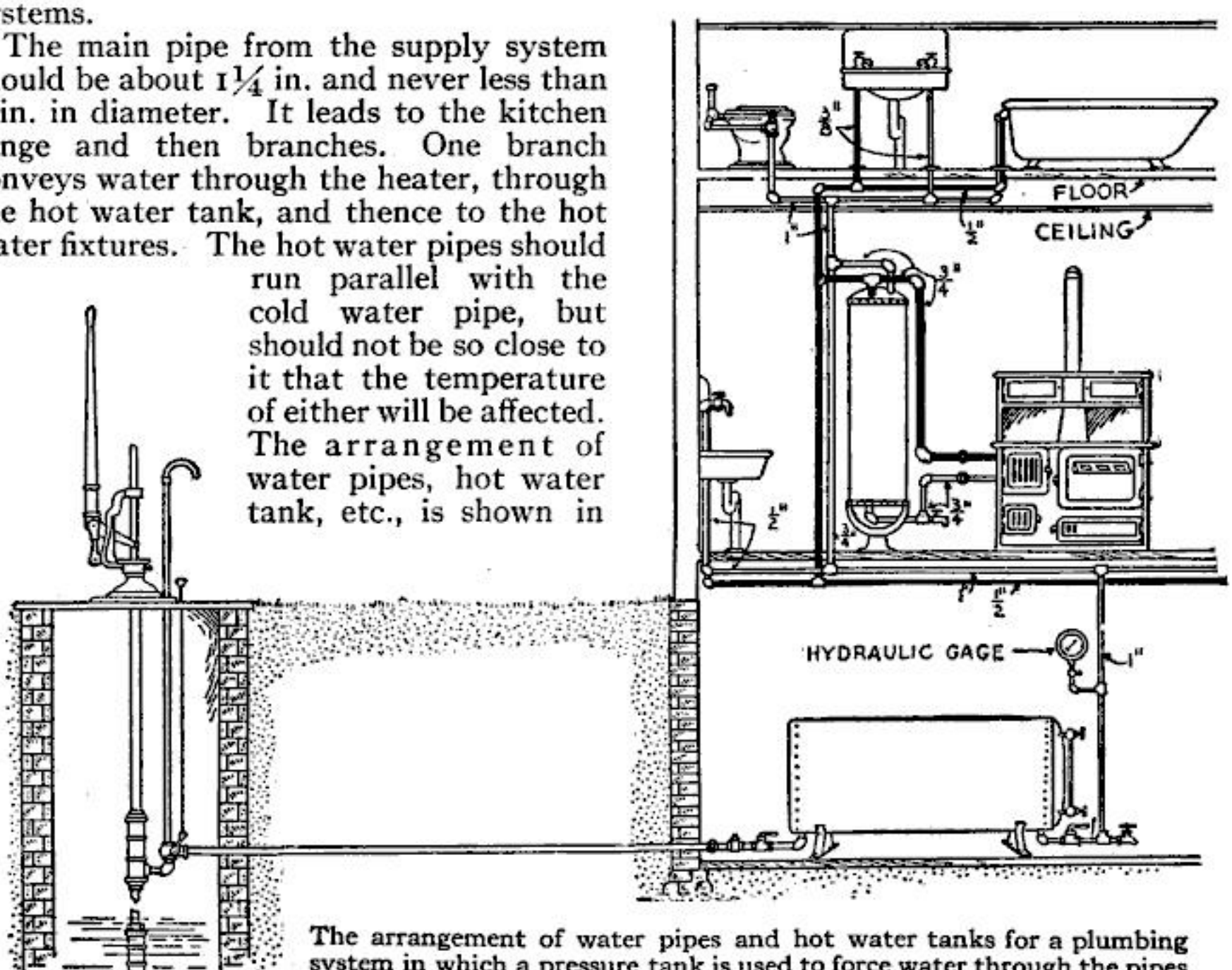
If tubs are used in the process of precipitating the blue they should be well dried and the hoops tightened before they are used and the interior coated well with amyl acetate collodion by flooding and draining, or a solution of rubber cement that has been thinned with benzine or benzole may be used. This coating will preserve the interior against the action of the chemicals. The tubs must be well water-soaked previous to use until all leaks have ceased. The stoneware vessels need no preparation.

If it is desired to manufacture this blue on a large scale care must be taken to get rid of the fumes resulting from the addition of nitric acid to the hot iron solution, because of their poisonous properties. Proper ventilation and respirators will protect the workers against any danger in handling the mixture.

A Plumbing System for the Farm Residence

THE important points to be considered in the arrangement of a plumbing system are durability of material and construction, and simplicity. Avoid any complication of pipes, and arrange the water pipes so as to carry the water to the point of discharge in as nearly a straight line as possible. The use of lead pipes or lead lines and receptacles for drinking water should be avoided in small private systems.

The main pipe from the supply system should be about 1¼ in. and never less than 1 in. in diameter. It leads to the kitchen range and then branches. One branch conveys water through the heater, through the hot water tank, and thence to the hot water fixtures. The hot water pipes should run parallel with the cold water pipe, but should not be so close to it that the temperature of either will be affected. The arrangement of water pipes, hot water tank, etc., is shown in the illustration. The hot water pipes are shown in black. All water pipes should be put in with red lead in the threads of the joints and all fittings should be screwed up tight. The natural direction of travel for the hot water is upward, and this should be aided, in arranging the hot water pipes, as much as possible.



The arrangement of water pipes and hot water tanks for a plumbing system in which a pressure tank is used to force water through the pipes

SUPPLY BRANCHES	LOW PRESSURE	HIGH PRESSURE
	INCHES	INCHES
To bath cocks	¾—1	½—¾
To basin cocks	½	⅜—½
To water closet flush tank	½	½
To water closet flush valve	1 —1¼	¾—1
To water closet flush pipes	1¼—1½	
To kitchen sinks	⅝— ¾	½—⅝
To pantry sinks	½	⅜—½
To slop sinks	⅝— ¾	½—⅝

The sizes of the pipes generally used for supplying water to the various fixtures are given in the table below:

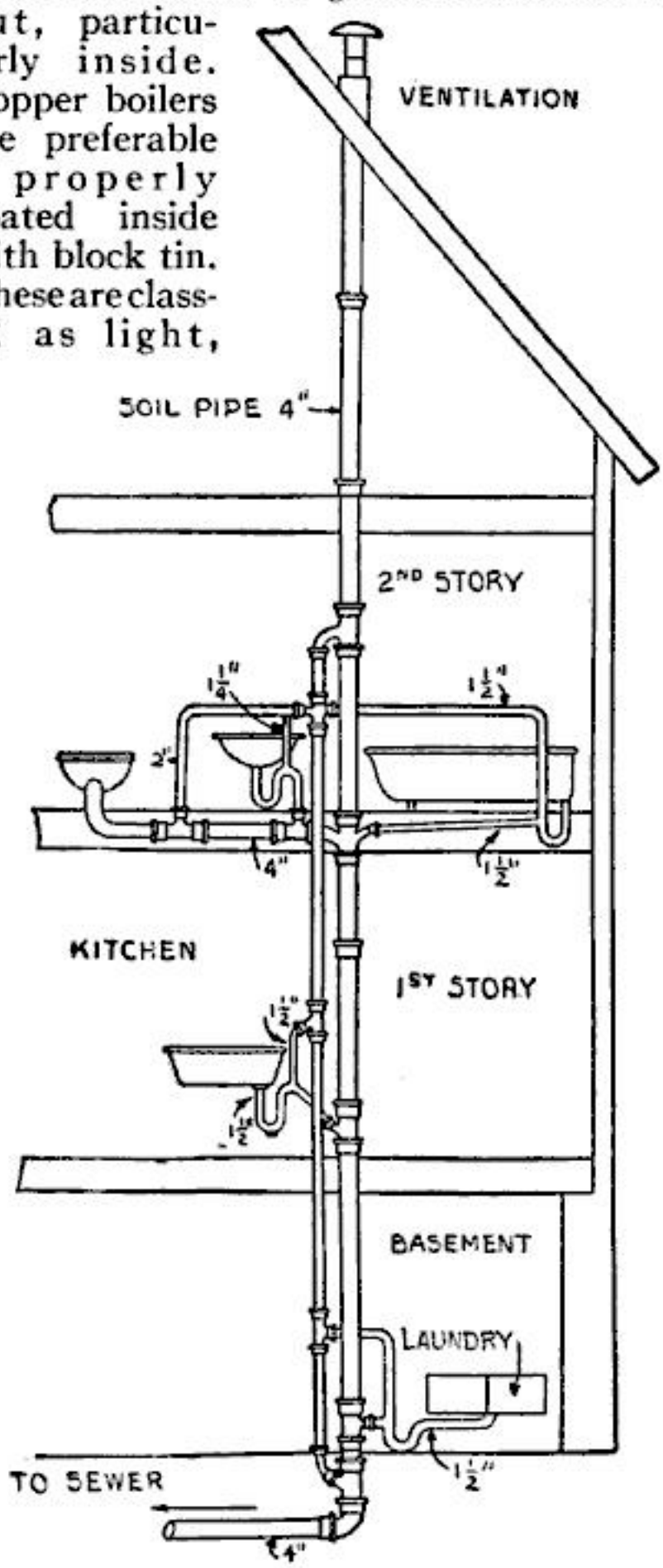
All water pipes should have sufficient slant to drain them back into the tank or drainage system, and a drain pipe and cock should be provided at the low point in the system, so that in extremely cold weather the system may be drained into the sewer or drainage system to prevent freezing. This necessitates a stop-cock on the pressure-tank outlet to prevent draining the tank.

Pipes should be kept from the outer walls to prevent freezing. Those located where they are in danger of freezing should be boxed in sawdust or some other non-conducting material.

Since a plentiful supply of hot water is desirable and a large quantity retains heat for some time, it is well to provide a fairly large hot-water tank. However, the size of boiler depends on the existing conditions, such as the water supply and the size of the building. A safe rule is to allow a 35 or 40-gal. boiler to a building having one bath-

room. Add 30 gal. additional capacity for extra bathroom. A water back having a heating surface of 100 sq. in. is sufficient for a 40-gal. boiler.

Boilers should be galvanized inside and out, particularly inside. Copper boilers are preferable if properly coated inside with block tin. These are classed as light, heavy and extra heavy, the latter being tested to 150 lb. water pressure. Ordinary steel or iron boilers are tested to 150 lb. water pressure and extra heavy ones to 250 lb. pressure. The latter should be used when the gage pressure is more than 40 lb. per square inch.



A drainage system of a residence to carry away the waste from the sinks and bath

Sewer Plumbing

The sewer plumbing serves as a drain for the water plumbing. The drainage system should be so constructed as to carry away completely everything emptied into it, and it should be constantly vented, frequently and thoroughly flushed, and have each of its openings into the house securely guarded. All drains, soil pipes, and waste pipe should be water-tight and air-tight.

NAME OF PIPE	DIAMETER
Main and branch soil pipe	4
Main waste pipe	2
Branch waste pipes for kitchen sinks	2
Bath or sink waste pipe	1½—2
Basin waste pipe	1¼—1½
Pantry sink waste pipe	1½
Water closet trap	3½—4
Wash tubs. Traps for two tubs	1½—2
Waste pipes for three or four tubs	2
Main vents and long branches	2
Branch vents for traps over 2 in	2
Branch vents for traps less than 2 in	1½

The soil pipe, or house drainage main, begins at the sewer opening and passes up through the house as nearly vertical as possible and out through the roof for free ventilation. It should be at least 4 in. in diameter, of extra heavy cast iron, and all joints should be tightly calked with lead and oakum. All discharge from the wash basins, sinks, and toilets empties into the soil pipe, and connections should be tightly made. The sewer inside the basement wall should always be soil pipe; tile should never be used except outside of the wall. A soil-pipe trap should be provided at the house foundation as shown. Every fixture should have a trap to prevent foul air from coming back through the waste pipe. Vent pipes should be provided on all waste pipes to prevent siphonage and the consequent destroying of the traps. A good arrangement of sewer plumbing is shown in the illustration. Note the traps and vent pipes on each waste pipe. The smallest sizes of waste and vent pipes are given in the table above.

All plumbing should be tested by filling with water or smoke to detect leaks.

AN ANNOUNCEMENT

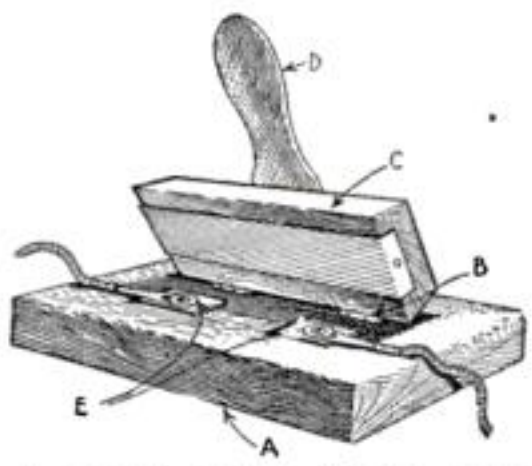
Owing to the fact that the last chapter on Winning an Athlete's Laurels covers all indoor events and does not contain any special features for this season of the year it will be concluded in a later issue, or one of the early winter month's, at which time all outdoor events will be discontinued and the athlete will be interested principally in something to occupy his leisure time indoors.

The Amateur Electrician

And Wireless Operator

A Quick Action Electric Switch for Photographers' Use

IN doing some work around my dark room I felt the need of an electric switch which would work more swiftly and easily than those sold by supply houses. The illustration shows a single pole switch that met my demands for something delicate and instantaneous in action and it was constructed quickly. The base *A* was made of well shellacked wood 4 in. long 2 in. wide and 1 in. thick. The hinges *B* fasten the block *C* to the base block *A*. The block *C* is about 2½ in. long and about 1½ in. wide. A handle *D* is fastened with screws to the piece *C*. The two terminals *E* consist of brass screws and washers on pieces of bronze or copper. Across the face of the block *C* is a strip of bronze tacked in place with small brads. Closing the block *C* brings the strip of bronze in contact with the terminals *E* which completes the circuit.—VIRGIL R. THARP.



A quick acting single pole single throw electric switch

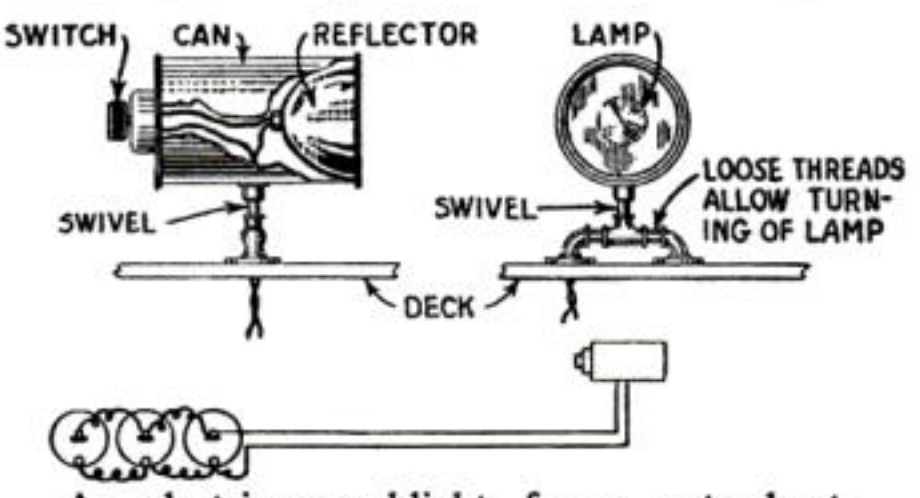
Making an Electric Searchlight for a Motor-Boat

A RELIABLE searchlight is a necessity for motor-boating at night, especially in crowded waters. The searchlight illustrated is for use on small craft not equipped with a generator and is operated independently of the ignition batteries.

For the light unit, purchase one of the hand lanterns that operate on one dry cell. Many types are on the market, but for this use it is necessary to select one with a large reflector. Procure a tin can into which the reflector of this lamp will snugly fit. To this can rivet a swivel arrangement, as shown. It is made from ½-in. nickeled pipe fittings and it consists of a flange, tee-joint, two ells with flanges and three short lengths of pipe. The flange is riveted to the side of the can and a hole is punched in the can so that the wires which come up through the piping may pass through.

The reflector and lamp are connected with the wires, a switch on the back of the can forms a handle to move the searchlight, and the reflector is soldered into place. The flanges on the ells are screwed to the deck and a hole is bored under one to pass the wires through. The wires should be well taped to prevent abrasion and a short circuit.

The battery for this light consists of two or three dry cells connected in parallel. The cells should be placed in a wood or pasteboard box, connected, then completely covered with melted pitch or paraffin. This effectively prevents short circuits and prolongs the life of the cells by hermetically sealing them. The wiring between the batteries and light should be rubber-insulated.



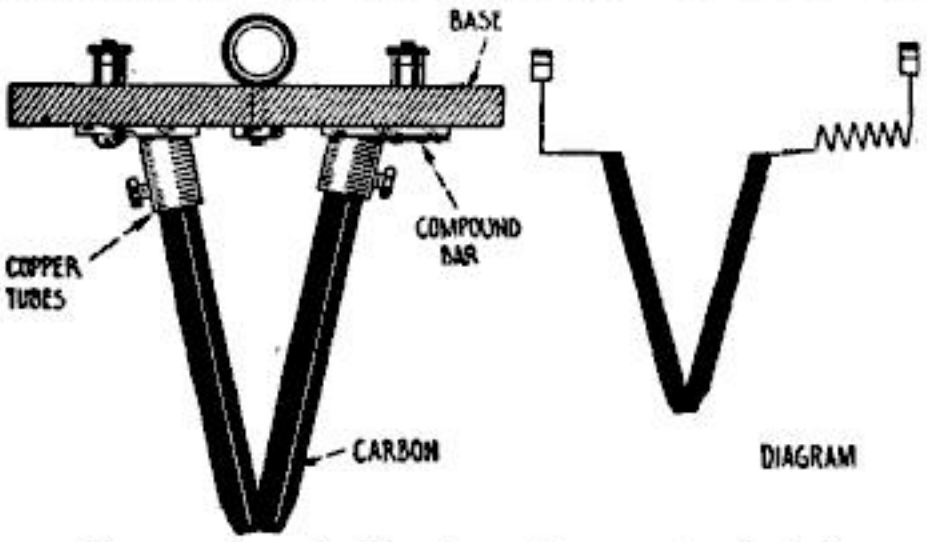
An electric searchlight for a motor-boat wherein only dry cells of battery are used

The light thrown is very powerful. If three batteries are used they will usually last a whole season. This is due to their parallel connection, which splits the load and lengthens the life. The light on a whole is neat and serviceable. A good

effect can be obtained by lacquering the container black and polishing the nickel parts.—THOMAS W. BENSON.

A Simple Arc Lamp Using a Thermostat Control

THE novel part of this arc lamp is the application of the active part of a thermostat for its control. A piece of



One carbon-holder base is constructed of two metals to produce thermostatic action

asbestos board ½ in. thick makes a good base. To this is attached a ring-bolt for hanging the lamp.

From copper tubing, ½ in. outside diameter, cut two lengths each 2 in. long. A hole is drilled through the wall of each tube and threaded for a ¼-in. bolt. One of these tubes is soldered to a strip of copper and clamped into position on the base by means of the binding post. The other tube is mounted on a heat-controlled strip formed by riveting together a piece of brass and a piece of sheet iron. The rivets should be spaced ½ in. apart.

Around this strip wind mica and then a single layer of No. 18-gage German silver wire. One end of this wire is led to the strip and the other to a binding-post. The carbons are slipped into the tubes and held there by screws. The two carbons are bent toward each other so that they touch. Care should be taken in mounting the compound strip so that the brass is next the asbestos base.

The operation will be clearly understood from the illustration. As soon as the current is switched into the arc it heats the German silver and causes the compound strip to bend, thus striking the arc. If the strip bends too far and breaks the arc add more wire and experiment in this manner until the arc burns steadily. It would be advisable to protect the strip from the heat of the arc by a shield made of asbestos board.—THOMAS W. BENSON.

How to Make Slow Acting or Sluggish Relays

PRACTICALLY all electrical circuits, and especially telephone and telegraph circuits, require relays. In telephone work especially, where several relays are used in one circuit, it is necessary that some of them shall be slow acting or sluggish. Such relays are used in circuits for a variety of purposes, the most important ones being: First, to prevent temporary disturbances in one part of a circuit from affecting some other part. Second, to secure a certain time interval between the operation of different parts of a circuit.

A relay in itself is not generally slow operating or slow releasing but such features are determined by a combination of the design of the relay itself and of the circuit in which it is used.

Relays may be made sluggish in a number of ways. The first is to equip the relay with either a heavy copper head at one end of the spool or a copper tube over the core the full length of the winding space. This is equivalent to a closed circuit winding having a single turn of very low resistance around the core. Similar results could be accomplished with a regular short circuited winding, although this would not be as effective as the copper head or tube. It has been found that the copper head is more effective with tubular type relays, while the tube over the core is more effective with the return gravity armature type.

The use of either the copper head or tube results in any change in the field setting up an induced current in the short circuited winding in such a direction as to oppose the change in the field. Such an induced current will be of very low voltage as there is only one turn around the core, but of high amperage due to its low resistance. If the thickness of the copper head or sleeve is increased the resistance of this closed circuit will be correspondingly lower, and hence the induced current will be stronger for any given operating current.

The operation of every relay depends upon a certain magnetizing force known as ampere turns and is the product of the number of turns in the winding and the current passing through it. If the winding and operating ampere turns are so chosen that the relay receives just enough current to operate it, the field will not become strong enough to move the armature until the effect of the short circuited winding has

been overcome and the field reaches its maximum strength. Such a relay will be slow in operating but may be made quick in releasing by choosing such a design that the releasing requirement will be high compared with the operating requirement.

If the winding and operating requirements are so chosen that the final value of the magnetizing force which the relay receives is much greater than the releasing requirement, then the relay will be slow releasing, as the magnetizing force will not decrease enough to allow the release of the armature, when the circuit is opened, until the effect of the short circuited winding has been overcome. Such a relay may be made quick in operating by choosing such a design that the releasing requirement will be low compared to the operating requirement.

In neither of the above cases is the rapidity of the movement of the armature itself greatly lessened, the greater delay occurring between the time of closing or opening the circuit and the beginning of the armature movement. The above construction is sometimes used for making a relay that will not readily respond to alternating current.

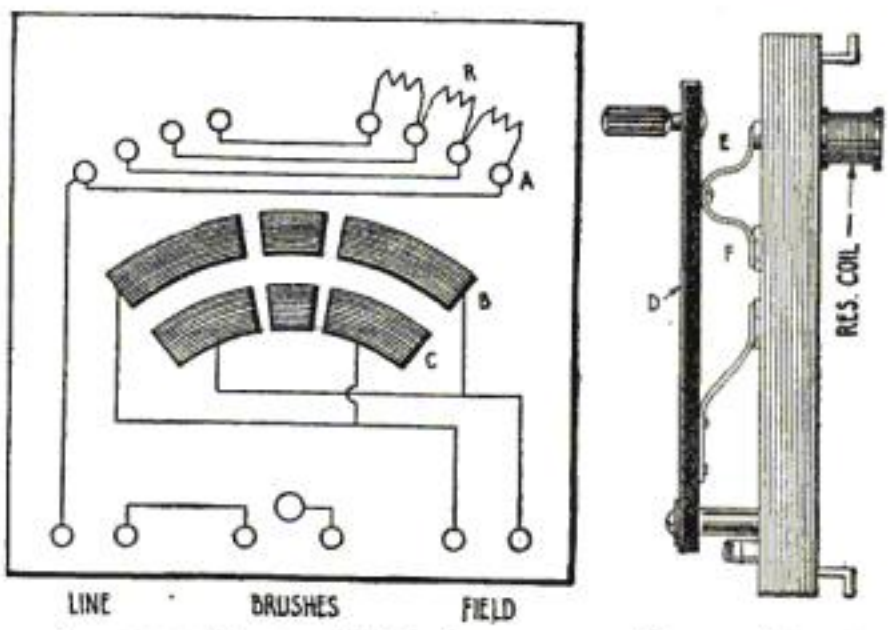
A second method is to use an external inductance or a non-inductive resistance which come under the classification of circuit design rather than the design of the relay itself, except where the non-inductive shunt is wound on the relay merely as a matter of convenience. Either of these means is used to cause the current through the winding to rise or fall more slowly than it would if no outside means was used to affect this time interval. The non-inductive shunt slows down the time of release but has practically no effect upon the time of operation, while the external inductance slows down the time of operation but has practically no effect on the time of release. Both effects may be accomplished by the use of the two in combination. As in the case of the first method the movement of the armature itself is not actually retarded. The action of such an arrangement is to increase the time between the closing and opening of the circuit and the beginning of the armature movement.

A third method is to make the moving parts of the relay heavy so that it will be slow in responding to changes in the magnetizing force. If the operating current is just great enough to pull up the armature, the relay will be slow in operating. To make such a relay slow in releasing, the restoring force, whether gravity or a spring, must be as small as possible and still cause the armature to fall back. Contrary to methods 1 and 2, with this construction the actual movement of the armature is retarded. Such relays are used extensively on alternating current, as their heavy moving parts prevent the opening of the relay contacts during the reversals of the current.

The circuit conditions in each case determine which of the above methods should be applied, although the first and second methods are the ones most commonly used. In some cases two of these methods are used on the same relay to meet certain peculiar circuit conditions.—F. H. Tillotson.

Reversing Rheostat for Controlling a Small Motor

IT is often desired to reverse the direction of rotation of direct current motors and at the same time adjust the speed to suit the new condition of operation. A serviceable controller may be made as shown in the sketch. The sets of contacts *A*, *B*, and *C*, should be of brass or copper, and mounted on a slate slab 12 in. square. The resistance coils *R* should be fixed to the back of the slate board. These coils, made of



A reversing switch in connection with a rheostat for controlling a small motor

German silver, should have sufficient resistance to give the proper speed control without over-heating.

Along the edge of the slate six binding posts are arranged and connections made, according to the diagram, on the reverse side of the panel. The switch arm *D* may be made from wood. The brass spring contacts *E* and *F* are connected so that

they will establish a circuit between the line of contacts *A* and *B*. The arm contact which presses on *C* is connected with the handle swivel and in turn with one of the binding posts.

It can be seen that when the handle is in the neutral position, no connection is made with the motor. Moving the handle to the right or left causes the motor to rotate either one way or the other. This is accomplished through a reversal of the field connections. After a direction of rotation is established, the speed is varied by progressing the switch handle from notch to notch on contacts shown at *A* in the diagram.—K. M. COGGESHALL.

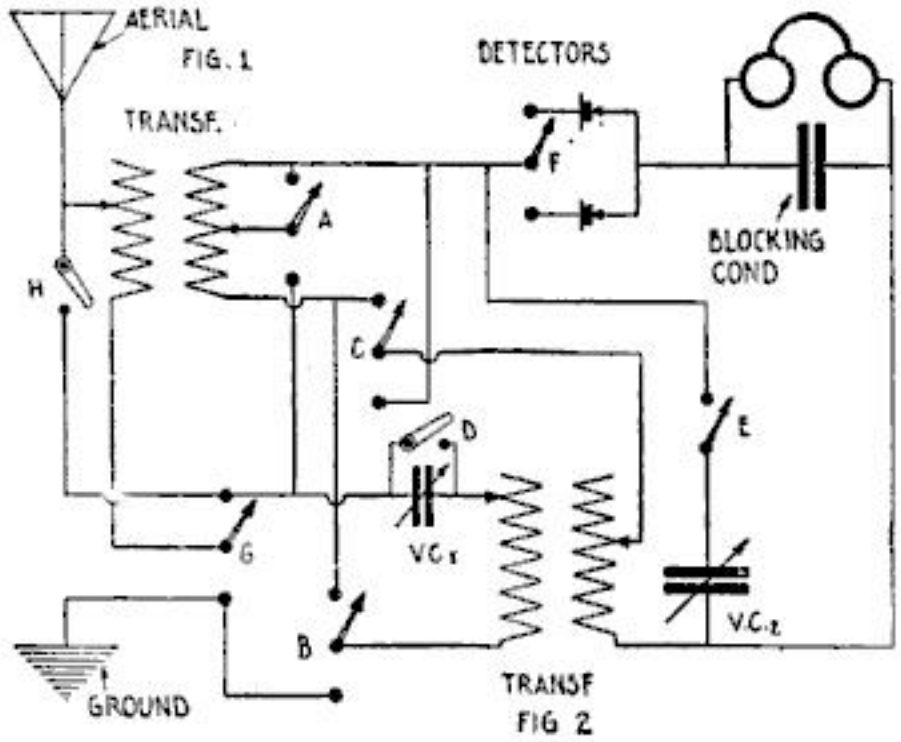
An Ingenious Wiring System for Two Inductive Transformers

THE accompanying diagram shows a very good wiring system for the experimental set. Five different connections are possible for the two inductive couplers by using five single-pole, double-throw, knife-switches. The inductive couplers are shown in Fig. 1 and 2, *A*, the Fessenden interference preventer, having the two primaries connected in multiple and the secondaries in series; *B*, the selective tuning with the secondary of the first inductive coupler connected with the primary of the second; and *C*, a long wavelength "hook-up" with both the primaries and the secondaries in series. A variable condenser with short circuiting switch *D* may be placed in series with the second primary, and another with open circuiting switch *E* may be added to time the secondary. The connecting wires should be of No. 18 gage lamp-cord as short as possible.

Circuit	H	G	A	B	C
Transformer Fig. 1 alone	out	down	up	out	up
Transformer Fig. 2 alone	down	out	out	down	down
Fessenden interference preventer	"	down	up	"	up
Selective tuning	out	"	down	up	down
Long wavelengths	"	up	up	down	up

Tabulation switch positions for the various circuits shown in the diagram of the wiring

A throw of the switches will tell which of the two transformers is the better. It is a good plan to have two detectors as shown connected with the switch *F* for the sake of comparing the different minerals, and also in case one gets "knocked out" in the middle of a message.—HARVEY N. BLISS.



Very satisfactory wiring diagram of two inductive couplers for an experimental set

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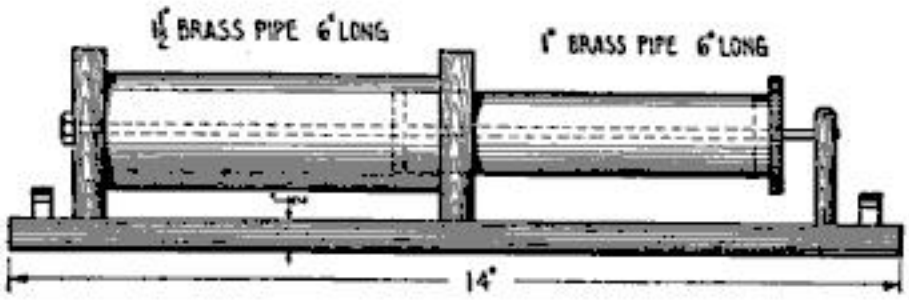
A Variable Condenser for a Radio Receiving Set

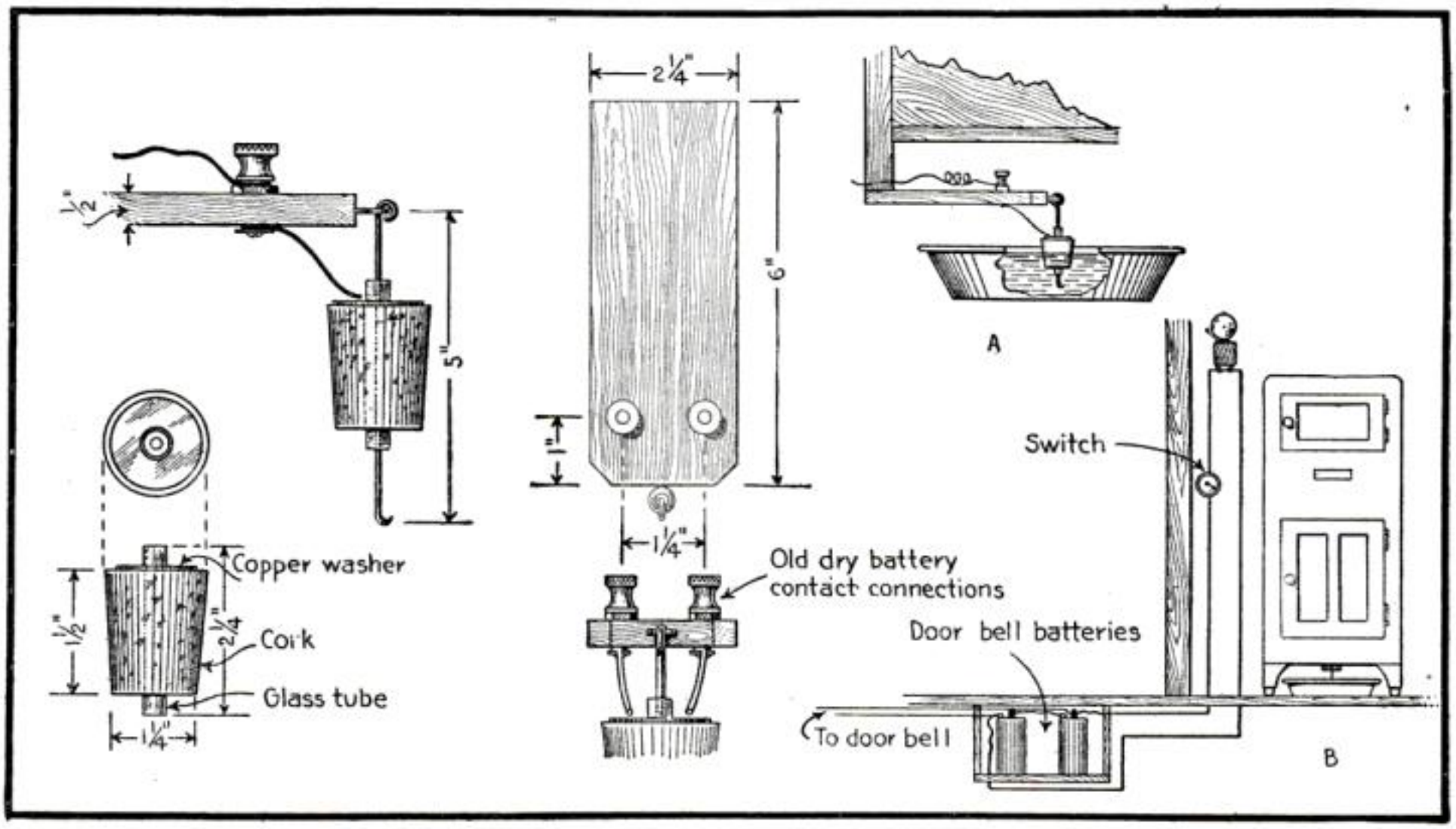
THE average amateur, in constructing his own wireless receiving apparatus, encounters his greatest difficulty in making a good variable condenser. A simple tubular condenser is shown in the illustration. It is easily constructed. The base is preferably of oak, 14 in. long, 3 in. wide and ½ in. thick. The ends which hold the large cylinder are each 2½ in. square and ½ in. thick. The brass pipes are 6 in. long and 1½ in. in diameter for the large one and 1 in. in diameter for the small one. A wire soldered to the stationary tube is connected with one binding post and a flexible cord which is soldered to the movable tube is connected with the other binding post.—THOMAS LEE HODGES.



A tubular condenser, if properly constructed, will serve just as well as a plate condenser

A Drip-Pan Alarm for the Ice-Box Drain

THE illustration shows a very neat and easily constructed drip-pan alarm which can be made by the home worker at a very slight expense. A small piece of glass tubing is run up through a cork float, on top of which is secured a light round copper washer. The cork with its guide hangs down into the pan from the under side of the base-piece of the refrigerator as shown in the illustration.



The cork float details and the manner of hanging it to the underside of a refrigerator to sound a bell when the drip-pan is about full and there is danger of it overflowing

It will be noticed at *A* that the permanent contact points or wires are so high that they in no way interfere with the sides of the pan when it is withdrawn to be emptied. The batteries of the door-bell circuit are utilized to operate the buzzer or bell of the pan-alarm, as at *B*. A simple one-point switch is placed in the circuit for convenience if the pan cannot be emptied at once, the contacts being so arranged that the alarm will sound continuously after the water is within 1 in. of the top of the pan.—F. W. BENTLEY.

Treating Cardboard Tubes for Tuners on Wireless Apparatus

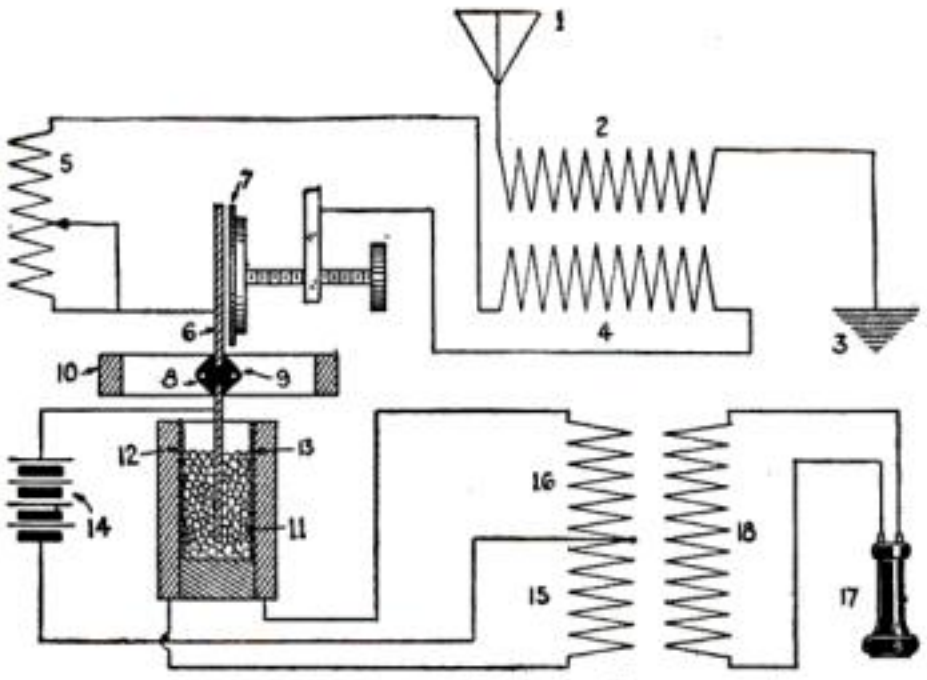
A GOOD way to make a cardboard tube non-shrinkable is to give it several coats of varnish before commencing the winding.—CHARLES WILDINGER.

An Amplifying Electrostatic Radio Receiver

IN THE development of radio telegraphy inventors have constantly striven to produce detectors or receivers which would be not only sensitive, but also rugged and easy to adjust and to keep in adjustment. Some of the instruments in common use meet these requirements, but in general the more sensitive of them are rather delicate in operation and seem likely to be rendered inoperative, or at least less sensitive, by receipt of loud signals or heavy strays. It has often been said that a wide departure from present principles would be necessary before an ideal receiver could be produced.

A device shown in 1916, United States patent to R. A. Fessenden, number 1,179,906, is interesting in this connection. A diagrammatic view of this instrument shows that the apparatus consists essentially of a combined electrostatic telephone and amplifying carbon microphone. The antenna 1 is connected through the tuned transformer primary 2 to earth 3, and coupled to the primary is the secondary coil 4. A secondary loading coil 5 is in series with this last-named inductance, and both are shunted by the static receiver consisting of the thin movable diaphragm or plate 6 placed close to, but not touching, the fixed plate 7.

The moving plate is pivoted on a vertical arm supported by two horizontal wires under tension, whose section is shown at 8, 9, and which are in turn held by the frame 10. The lower end of the vertical



A combined electrostatic telephone and carbon microphone that is sensitive and rugged

arm carries an electrode which dips into the carbon granules of the differential microphone amplifier 11. This variable-resistance cell has two opposing contact surfaces 12 and 13, and is in circuit with the battery 14 and the divided primary winding of the telephone transformer 15, 16. The telephones 17 are connected to the secondary 18.

In operation the supporting wires are stretched to the tightness which tunes them to vibrate at the group frequency of the desired incoming signals. Currents induced in the antenna by the arriving waves produce opposing charges upon the plates 7, 6 and cause an attraction. This moves the lever toward the contact 12 and away from 13, so changing the current in both branches of the primary of the telephone transformer. By suitably winding these two coils the effects upon the secondary are made to add, and the change of current resulting in the circuit containing the telephone causes it to respond. By this resultant action it becomes possible to secure responses to comparatively weak signals of the desired group frequency, while interference of other spark frequencies is largely reduced.

The same apparatus may be used on the heterodyne principle, by adding a local source of sustained waves which will interact with the incoming signals to produce musical-toned beats. In this case the sensitiveness of the device is still further increased. The tension of the supporting wires is adjusted to the pitch of the beat-note.

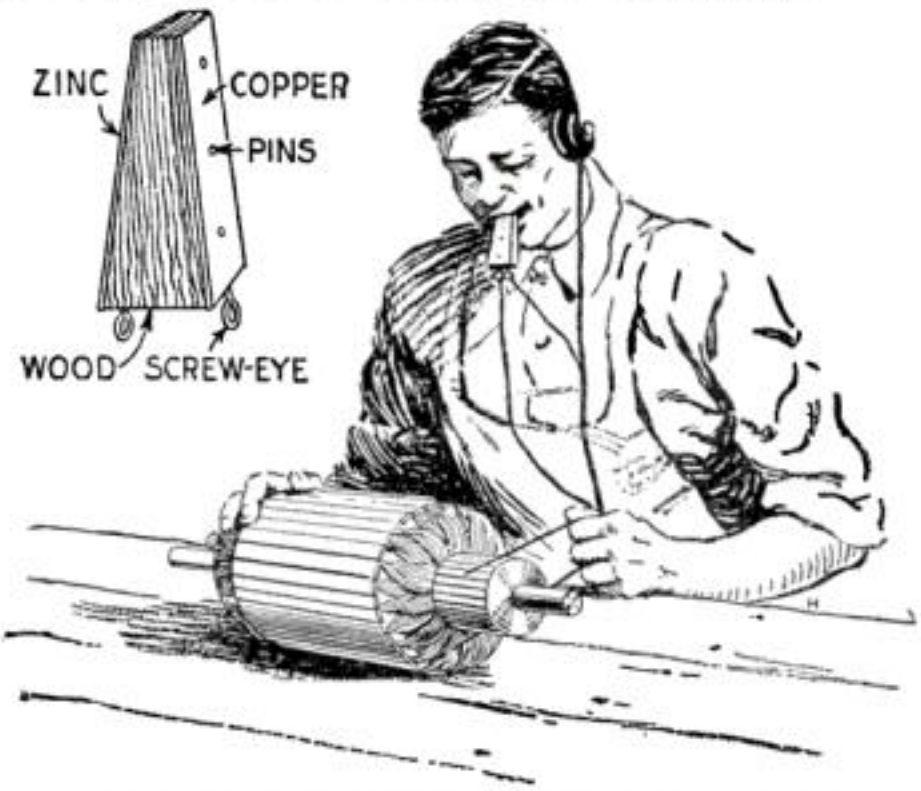
Strong Wireless Signals in Winter Time

A SERIES of tests lasting over two years were completed some time ago, with the object of finding out how much stronger radio signals between two selected stations would be in winter than in summer. The test signals were sent nearly every day during that time, and the amount of power sent and the intensity of signals received were carefully measured. It was found that the best time of year was from November to February, and that then the messages were about six times as loud as during the months from May to August.

A Testing Set That Does Not Use a Battery

THE testing set illustrated, which does not use a battery or magneto in the circuit, is novel and interesting. The current used is set up by the action of the saliva on the zinc and copper plates. While it is not recommended for constant use it can be worked in case of emergency.

The mouth piece is made of wood or fiber cut tapering at one end. It is about 2 in. long, ½ in. wide and ¼ in. thick. A piece of sheet zinc is cut 2 in. long and ¼ in. wide, also a piece of sheet copper of the same dimensions. These metal strips are fastened to the edges of the insulator so that there is no contact between them. Solder a small screw-eye on the outer end of each piece of metal for terminals.

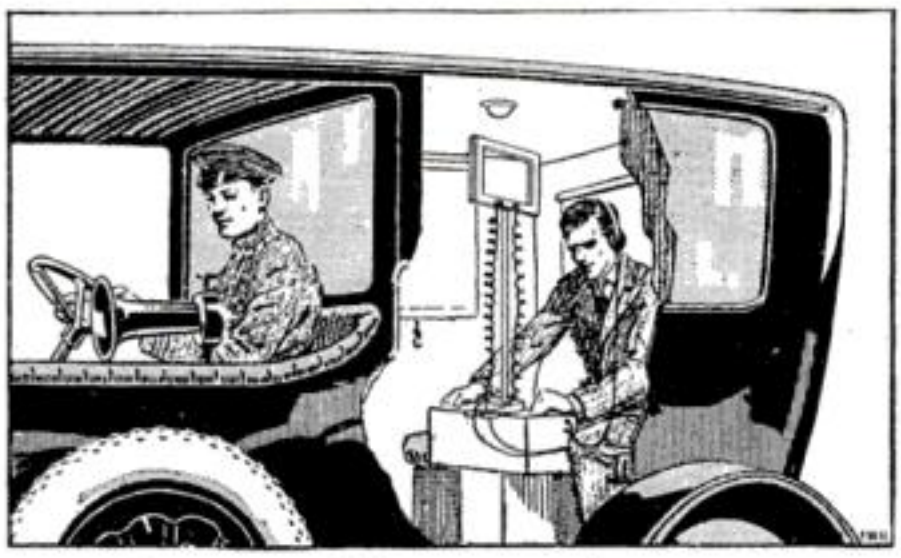


The current for making the test is set up by the action of the saliva on the metal

Connect a single head receiver in series as shown and place the block in the mouth. A distinct click may be heard when a clear circuit is made.—ALBERT FERTICK.

How the Radio Inspectors Trapped a Disorderly Amateur

JUST before Secretary of the Navy Daniels issued his order for the dismantling of all unofficial wireless stations, the Government radio inspectors about New York found it necessary to track a disorderly amateur who continued to send



An automobile was used to carry about a simple loop direction-finder

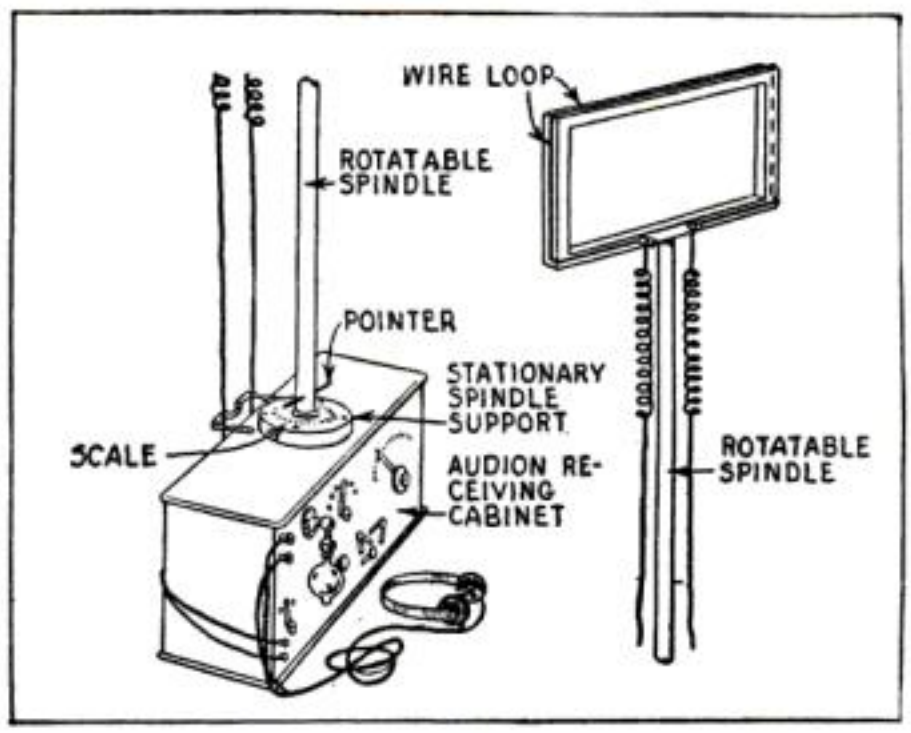
out false "S O S" signals. Their method of running down this amateur is of especial interest now that we are at war.

The false distress signals were sent out every night or so. Luckily the wavelength was short and ships at sea did not hear them. But the *Herald* wireless station and the Brooklyn Navy Yard did. Recognizing the signals to be the work of an amateur, they immediately reported to the authorities, and Louis L. Krumm, chief radio inspector of the Department of Commerce, started on his track. He first acted upon a hint from the *Herald* operator who explained that he could hear the signals more loudly on his own apparatus in Brooklyn than on the sensitive instruments in the *Herald* station in Manhattan.

This at once confined the search to Brooklyn. To locate the transgressor exactly, a small directive-loop receiving set was "hitched up" in an automobile which was run about the Brooklyn streets. The wire loop was about four square feet in area, and could be turned about to face in any direction. The circuit of this loop was closed by the ordinary condenser and coupler secondary of an audion receiving outfit (see illustration at right).

Starting from a given point in Brooklyn, the inspectors found that when the plane of the loop was turned in a certain direction the "S O S" signals were heard most plainly. This meant that the amateur's station lay somewhere along that direction; for, as every amateur should know, when a wireless wave passes through a wire loop end-on, the electromagnetic lines of force will induce a certain current in one vertical wire of the loop, and a different electric current in the other vertical wire, the resultant current flowing around the loop being equal to the difference in these two induced currents. The reason why the two induced currents are different is shown in the diagram on the following page. At *A* the lines of force pass through the loop end-on, and the intensity of the lines of force cutting the vertical wire nearer the sending station *S* is less than that of the lines cutting the other vertical wire, causing a corresponding difference in the two currents. Obviously, the resulting current flowing in the loop is a maximum and the signals are heard the loudest when the loop is pointing directly towards the sending station, as the loop at *A* is doing. At *C*, on the other hand, the two vertical wires are equally distant from the station *S*. The *same* current is induced in the two wires, since the same intensity of the lines of force are cutting them. The induced currents, on "bucking" each other, are simply neutralized and no resultant current will affect the audion detector coupled to the loop.

Now that the radio inspectors knew one line of direction to the amateur's



With the regular audion equipment, a wire loop was used instead of an aerial ground

station, they immediately proceeded at right angles to this line of direction; as from *A* to *B* in diagram. At *B* they determined a new line of direction to the culprit by again turning the loop around

to the point from which the signals were heard most clearly. Then they knew that the amateur must be located at the point where these two lines of direction intersected!

After repeating their maneuvers many

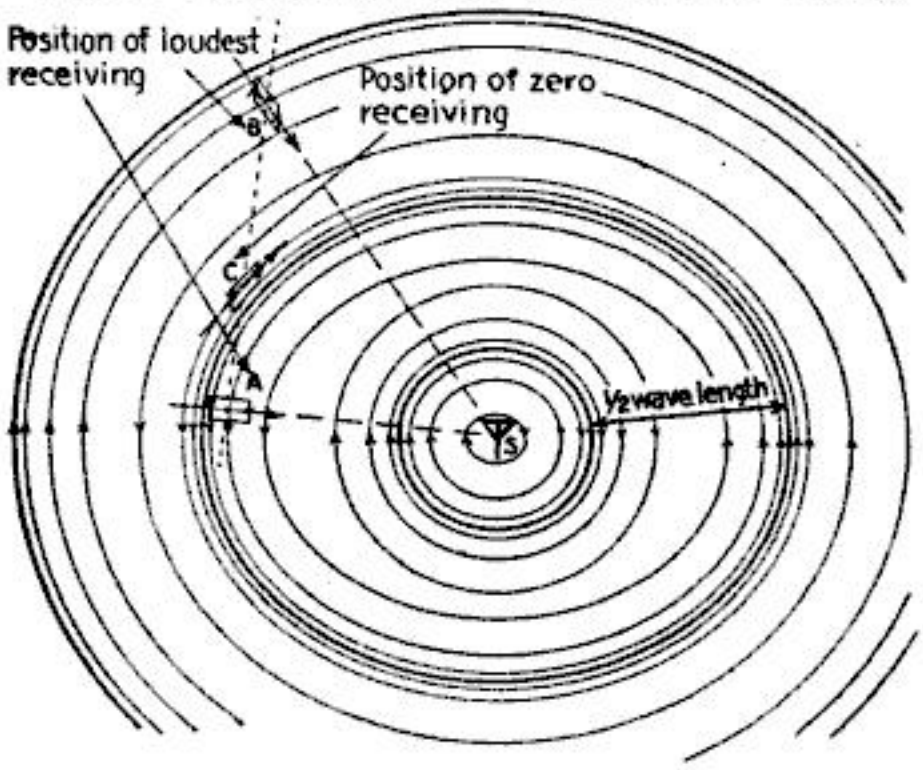
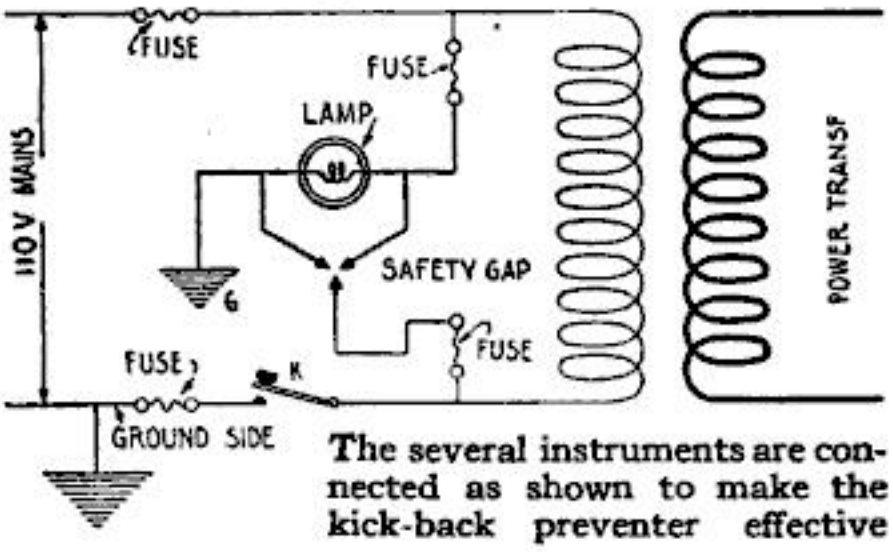


Diagram illustrating the principle employed to locate the sending station

times, continually getting nearer and nearer to the unsuspecting amateur, the inspectors found themselves within a block of his station. The rest was easy. There was only one antenna on that block from which the signals could come. The arrest of the youngster followed. Needless to say he has been taught a lesson and is not likely to cause any further trouble.

How to Make a Kick-Back Preventer for Wireless Apparatus

IN many instances where a wireless set is employed for sending purposes the fire underwriters require a kick-back preventer.



The several instruments are connected as shown to make the kick-back preventer effective

This piece of apparatus is, in some cases, expensive to purchase; but it can be easily made, at little expense.

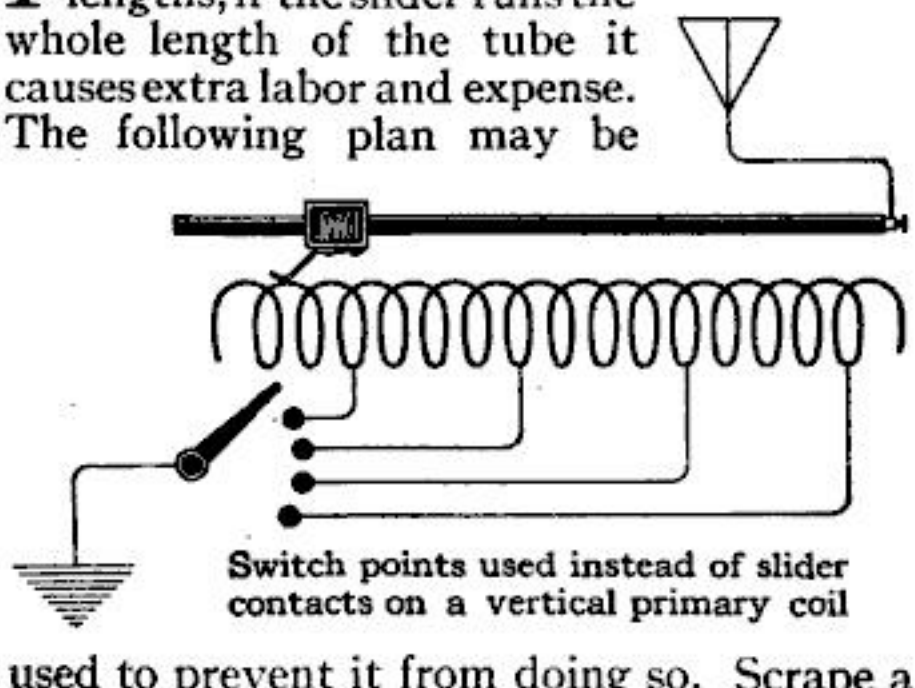
The essentials are a 16-C.P. carbon filament electric-light bulb, with a socket to fit it—a Mazda bulb will not do—two fuse-blocks and fuses, three binding-posts with holes in the center to admit pieces of copper wire, and a baseboard on which to fasten the apparatus. The binding-posts are used for a three-point safety-gap. The several instruments must be carefully connected as in the diagram, or the coil will not work.

This device is intended for 110 volts with grounded power line. To find the grounded side of the line take a 110-v. bulb, with wires attached, and connect one wire with the ground and the other with one of the mains. The bulb lights only when it is connected with the other main—not with the grounded side.

In using this kick-back preventer, when the key is pressed the bulb will light up and the coil or transformer will operate. In case of a kick-back this device will send the excess current into the ground, and will save the coil and fuses from burning out.

Variable Primary Coil Using a Switch Instead of a Slider

IN winding tuning coils for long wavelengths, if the slider runs the whole length of the tube it causes extra labor and expense. The following plan may be

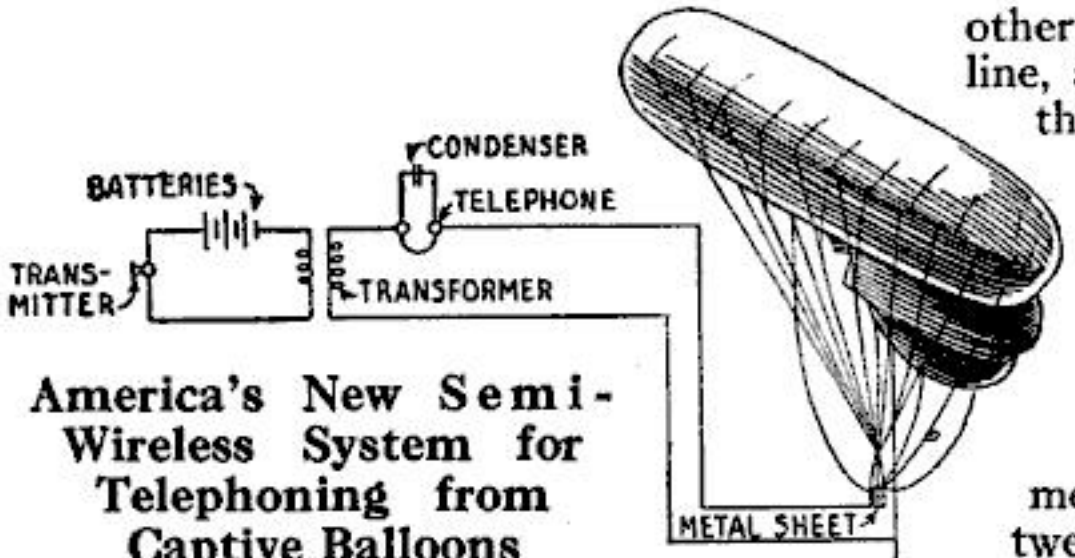


Switch points used instead of slider contacts on a vertical primary coil

used to prevent it from doing so. Scrape a few inches of the wire and use a rod of the length designated. At intervals equal to the length of the scraped wire take off taps and run leads to switch-points. The finished coil is manipulated in the same way as the primary of a Navy type inductive coupler.—GLENN DUNFEE.

A Use for Discarded Cylindrical Food Boxes

CYLINDRICAL cardboard boxes, such as certain food products are packed in, make excellent forms upon which to wind tuning coils. By using two, one of which is slightly smaller than the other, a very satisfactory inductive coupler may be made.—EDWARD MCCLURE.



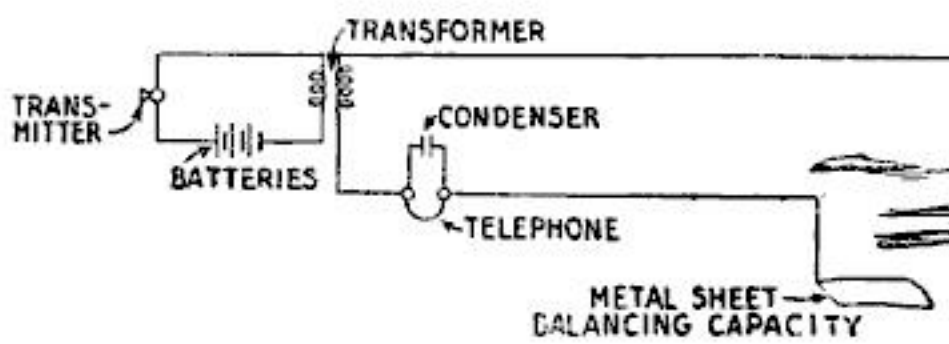
America's New Semi-Wireless System for Telephoning from Captive Balloons

WHAT will be still another addition to the long list of America's contributions to the technique of modern warfare is a *wired*-wireless system for communicating from balloons. The gun-fire of artillery is directed, as everybody knows, by battery commanders who ascend to high altitudes in anchored balloons. From here the commanders take their observations and telephone their orders down to their batteries which may be concealed several miles away. To provide suitable telephone transmission lines, the Allies have been using the wire cables which anchor the balloons. They have built these cables up with an internal steel core which they insulate from the outer strands. But in providing two insulated conductors in this way, they were compelled to use a bulky, very expensive cable which was likely to be rendered worse than useless if too roughly handled. For if once this cable should become injured and the two conductors become short-circuited, the telephones could not work and the commander would be cut off from his men.

The semi-wireless system which has just been brought out by William Dubilier and Robert Goll, two American engineers, does away with any need for the internal core. Their system, which is fully protected by patents, is expected to be officially adopted by our Government. For connecting paths between the balloon and the ground, the new system uses an ordinary solid steel cable as one path, and the air itself as the other. It therefore uses one transmission line, as in wire telephony, and it also uses the air as in wireless.

Considering the diagram of connections it will be seen that the system has one secondary circuit consisting of the secondaries of the two telephone transformers, of the two telephone receivers and their shunt condensers, and of the two metal sheets which, with the air between as their dielectric, form a balancing capacity. This one secondary has two primaries: the telephone transmitter, batteries and the primary of the transformer, in the basket, and the similar instruments down below at the gun battery. The three circuits are mutually tuned to provide a maximum of current in the secondary.

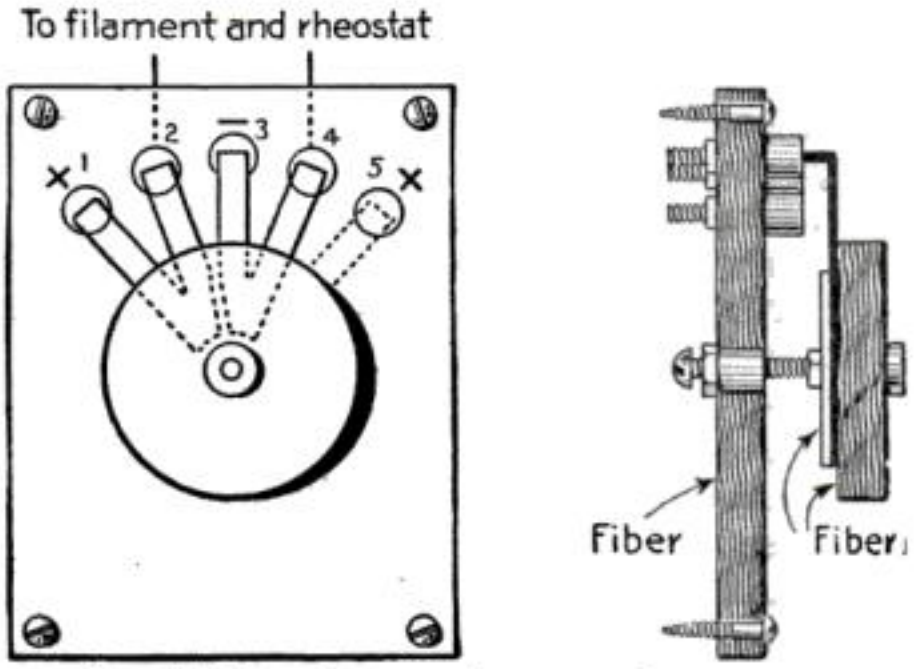
When the commander talks into his transmitter, the corresponding primary current is modulated accordingly. The variations in the primary currents are induced into the secondary through the step-up transformer. Here the variations become very marked, due to the strengthening effect afforded by the inductance of the transformers and the capacity of the air-condenser, which together naturally tend to cause the secondary current to oscillate. These variations are changed into sound waves by the telephone receivers—and the gun captain thus receives his orders.



A Polarity-Changer for Reversing Lighting Battery Current

SOME audion detectors work better if the current from the lighting battery is reversed. To do this quickly a polarity-changer is very handy. There are many kinds of polarity-changers, but the one here described is very compact and looks neat. To make it, mount five contact points on a fiber-base as shown in the drawing on the following page; space them about half their diameter apart. The positive side of the battery is connected with No. 1 and 5; the negative with No. 3, while No. 2 and 4 are connected with the fila-

ment and rheostat in the circuit. The two brass contact-arms on the switch-handle are insulated from each other and are of the edgewise-contact type. They should be made of thin spring-brass and split at the end as shown, so that each blade will make perfect contact with two points at a time. The switch-arms are fastened to the handle by laying them on the back of the insulating



A polarity changer for reversing a current taken from a lighting battery circuit

handle in their proper position, placing over them a fiber-washer and drawing it up tight against the blades by means of a nut screwed on to the bolt through the handle. Adjust the knob so the ends of the blades strike the contacts in the center. Then adjust the blades so that when one arm is in contact with No. 2 and 1, the other is in contact with No. 3 and 4; and when one connects No. 2 and 3 the other connects 4 and 5. Care should be taken to see that all contacts are the same height and all equally spaced; for then it will be easy to get each arm to touch two contacts. A good holder for the handle is made of an old binding post which has a wide base. Force the post into a hole in the base with the base projecting, in order to keep it from going clear through. The shaft on the handle is then screwed into this until the contacts are made certain by the pressure of the spring. Be sure that a good contact is made, otherwise the instrument will be inefficient.—FRANK SAHLMAN.

A Simple and Dependable Multiplication Method

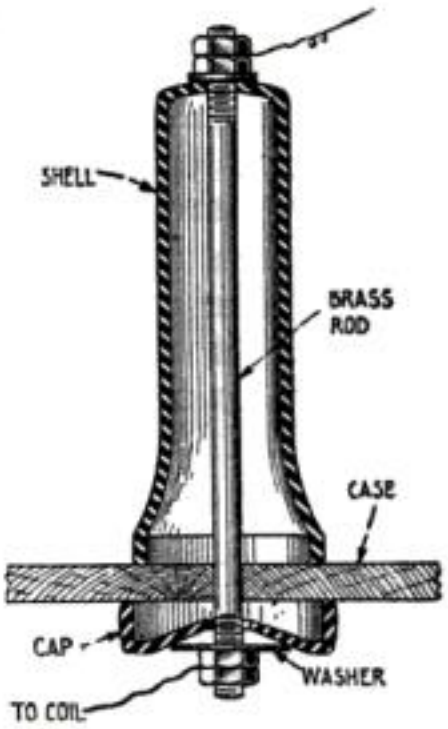
AN interesting and simple method of multiplication is performed as follows: Suppose, for example, that it is desired to multiply 145 by 39. Write 39 in one column, 145 in a second. Divide 39 by 2, neglecting the remainder, and multiply 145 by 2; write the first result in the first column, the second result in the second. Continue the process of dividing the number in the first column by 2 and multiplying the number in the second column by 2 (always neglecting the remainder if one occurs in the division) until the number in the first column is 1. Then strike out all of the numbers in the second column that are opposite even numbers in the first column and add the numbers remaining in the second column. The result will be the required product. The work for this problem is shown:

39	145
19	290
9	580
4	~~1160~~
2	~~2320~~
1	4640
	5655

The method depends on the fact that any number may be expressed as the sum of powers of 2 (including $2^0 = 1$). The number 39, for instance, is equal to $2^0 + 2^1 + 2^2 + 2^5$, that is, $1 + 2 + 4 + 32$. The numbers remaining in the second column are 1 x 145, 2 x 145, 4 x 145, and 32 x 145, so that their sum is equal to 39 x 145.—PAUL R. RIDER, Ph.D., Instructor in Mathematics, Yale University.

An Insulation for Secondary Terminals on Transformers

THE insulation of secondary terminals on home-made transformers is often very poor, resulting in leakage and lowered efficiency. The hard rubber shells from telephone receivers can be used in such cases with excellent results. The shells should be mounted as shown in the illustration. A long brass rod threaded on both ends is run completely through the device and clamps it firmly in position. Connections are easily made with both ends of this rod.



Method of mounting the shells for insulation

Wireless Work in Wartime—I.

The beginning of a series which will cover every present-day application of the principles of wireless

By John L. Hogan, Jr.

IN military and naval warfare there are many times when no man is of more importance than the radio operator. Upon his speed and accuracy, and on his knowledge of the principles of his apparatus, may depend the failure or success of great strategic moves. Radio amateurs and operators, as well as those who have an aptitude for this work and are now taking it up, are indeed fortunate in having the opportunity to serve the Nation so well in the present crisis. Radio operators are needed in the Signal Corps of the Army and in several branches of the Naval service, including the new fleet of submarine chasers now being equipped. The call for men to take up these classes of military work will leave other positions open, particularly with the commercial radio organizations, positions which probably can be effectively filled by competent women. There is and will continue to be a demand for skillful wireless operators, both experienced and newly trained.

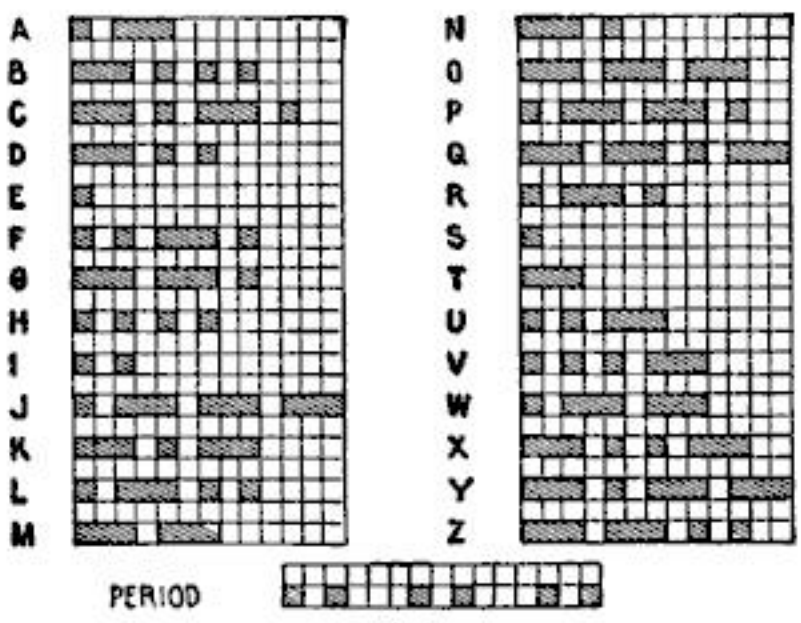


FIG. 1

Letter chart with dots and dashes plotted on cross section paper to show length of spaces

Fundamental Knowledge

The fundamental knowledge which all radio operators must possess relates to the use of the Continental or International Morse code. It is absolutely essential to be able to send well-formed Morse characters rapidly, and to have the ability to write clean "copy" when receiving signals from a distant station. Without this ability none can claim to be a radio operator. And of only slightly less importance is the understanding of the basic principles of the apparatus used, together with the ability to adjust it quickly and accurately. This first article will take up the study of the code, pointing out not only the best and quickest way to learn it but also the elements which characterize good and bad sending. Just as many engineers fail to appreciate what is going on inside their instruments, so many operators fail to realize that there are good reasons for a number of rules of sending which appear unimportant at first glance. Either attitude leads to results which must necessarily be poor when compared with what is attainable by a little careful study.

It has been stated as a general rule that men and women who have a feeling for musical rhythm make the best telegraphers. It seems curious that the same quality of beating time enters so strongly into both music and telegraphy. A keen time-sense, or the ability to note and correct small variations in time intervals, is of extreme importance to the telegraph operator. This is because the telegraph signals are sent by turning electric currents on and off for definite times. The elements of the Continental code are dots, dashes and spaces. Spaces of various lengths are merely periods of idleness, when no current is turned on. They occur between letters and between words, as well as in separating the dots and dashes which combine to form each character. The dot is the short active element, and is formed by turning the current on for a brief time; the dash is a longer active element, made by allowing the current to flow about three times as long as for a dot. Various combinations of dots and dashes stand for the various letters of the alphabet, and words in any language are spelled out letter by letter.

Learning Telegraphy

There are three steps in learning telegraphy: viz., memorizing the code, manipulating the sending key, and writing out incoming messages (reading by sound). These are independent to some degree, but

the study of each promotes progress in the other two; consequently, all three should

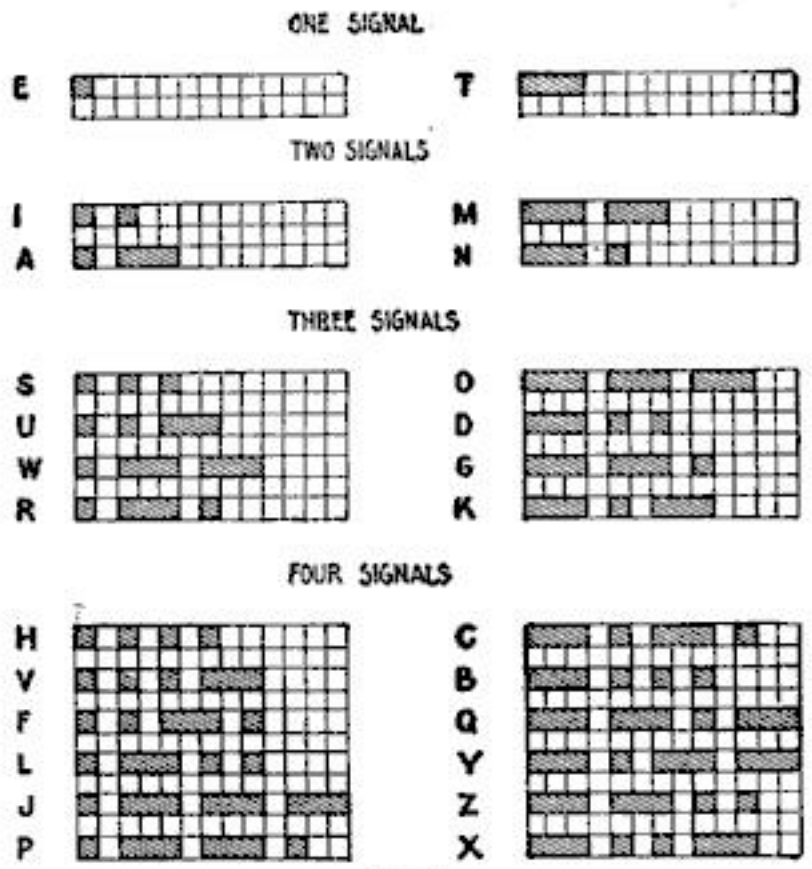


FIG. 2

Letters divided into four classes of one, two, three and four signals, dots and dashes

be carried along together. The first two can be studied easily without assistance; but practice in sound reading requires either a companion student or a skilled telegrapher with whom to practice sending and receiving messages, or else an automatic sending machine. Probably the most interesting, and certainly one of the most effective, ways to learn the code is to practice it with another student of about equal ability. Thus there is the incentive of competition, and, from the very first work, the satisfaction of actually communicating with another person through the vehicle of the Morse code. The only difficulty in pursuing this two-student method lies in the danger of falling into improper habits of sending (e. g., incorrect spacing); but this can be corrected by getting the occasional criticisms of a skilled operator.

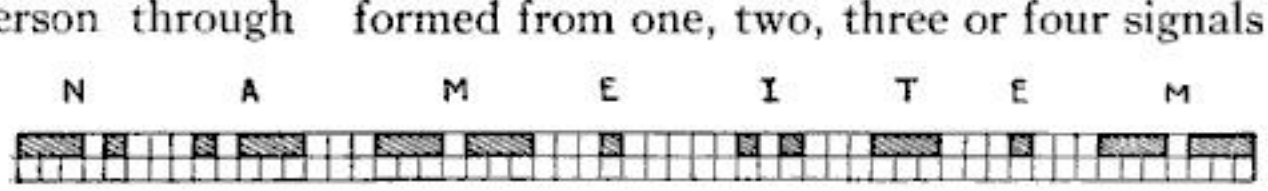
Memorizing the Code

The first thing, then, is to memorize the code itself. Without the ability to call to mind instantaneously the dot-and-dash symbol corresponding to each letter it is impossible to operate effectively. One must be able to recall the Morse equivalent of any character without any mental effort —the process must be automatic or subconscious before satisfactory sending can be done. The only way to get this rapidity of translation from written letters to Morse letters is by continued practice.

In Fig. 1 is reproduced the most important part of the code, i. e., the symbols which represent the letters of the English alphabet and the period. With these twenty-seven characters in mind, any message can be transmitted. Numerals and punctuation marks other than the period may be spelled out by name, so that for the first work it is only necessary to memorize these. It will be noted that the letter chart of Fig. 1 is different from that usually used for showing the Morse code, in that the dots and dashes are plotted on square-section ruling. This shows at once the time allowance which should be made for each dot, space and dash, since each small square represents the time of a "dot-element." This dot-element is about one-twentieth of a second long in moderately fast sending, and is the length of time the current is turned on to form a dot. It is equal to the length of time the current is allowed to remain turned off to form a space between dots and dashes within the same letter. It is one-third of the time the current is turned on to form a dash.

Subdividing the Alphabet

In memorizing the code it is best to take up the letters in groups. Several modes of division are practicable, but the best seems to be that illustrated in Fig. 2. Here the characters are divided into four classes, according to whether they are formed from one, two, three or four signals (dots or dashes). The simplest characters are E and T, which comprise a single dot and single dash respectively. These are very easy to remember, so that one may proceed at once to the two-signal letters I, M, A and N. It will be noted that the left hand part of the chart is devoted to the letters in each group which begin with a dot, while the right hand part shows those commencing with a dash. Wherever feasible to do so, letters which are the reverse of each other are arranged side by side,—for instance, A is dot-dash, and



F16.3

A time layout of normal spacings, but for the sake of clearness the space between words and letters should be slightly exaggerated

N, beside it, is the exact reverse, namely, dash-dot.

Having the six letters of the first two groups fairly well in mind, practice in word-formation should be begun. A number of simple words can be formed from these letters alone, and they should be practiced until there is not the slightest hesitation in spelling out any word using these characters. In learning the Morse symbols the signals may be called by name at first, but it is well to accustom oneself to the corresponding signal sounds almost from the beginning of study. That is, instead of continuing to call M "dash dash" or "two dashes" the student should begin very early in his work to attempt to reproduce the sound of the signal itself. This may be done by whistling or hissing for short or longer times, representing dots and dashes, and so imitating as nearly as may be the actual sound of the wireless or buzzer signals.

Word Practice

Practice words, using the first six letters learned, are as follows:

ATE	NAME	TIE
MAIN	AIM	MAT
TAME	AMEN	MAIM
EAT	MAN	MEANTIME
TIME	NEAT	TEAM
EMIT	MIEN	ITEM

In spelling them in Morse, great care must be taken to give every dot and dash its full value of time, and particularly to space the letters properly. The space or idle interval between every pair of signals within the same letter is equal in length to the time of a single dot. The space between letters is longer, and equal to three dots (the time of a dash). At first it is a good plan to make the space between letters even longer, so that there can be no confusion. Even skilled operators occasionally run letters together to form "combinations" which are difficult to read and which often lead to errors in the transmission of messages. The space between words should be still greater, and equal to the time of at least five dots.

The thing to bear in mind constantly is that the operator receiving your message can not transcribe it correctly unless you form your characters correctly, and that you must consequently strive to make perfect signals built up of perfectly formed dots and dashes carefully spaced. Fig. 3 shows the time-interval layout of the words NAME ITEM, with normal spacing between signals, letter and words; in practice the spaces between signals within a single letter should not be longer than the dots, but it is often well to exaggerate the spaces between letters and between words, for the sake of clearness.

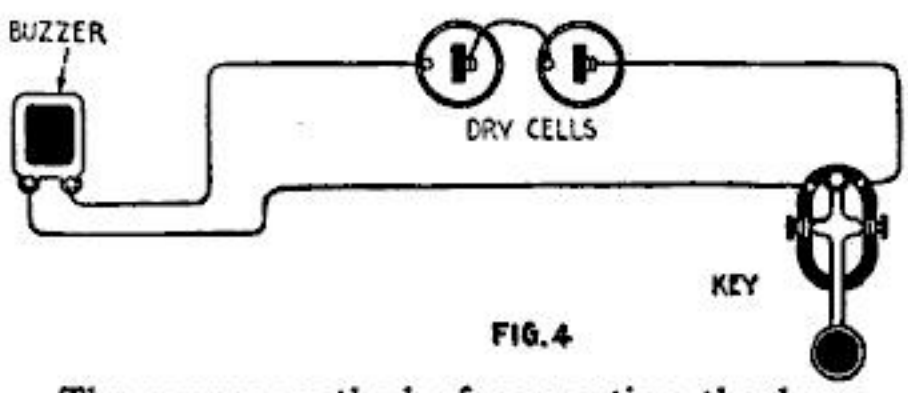


FIG. 4

The proper method of connecting the key, buzzer and battery together on a circuit

Using the Buzzer

Before taking up the third and fourth groups of letters (Fig. 2), buzzer practice should be commenced. This will require a buzzer, a Morse key and one or two dry-cells. The key should be purchased rather than home-made, and should be of the regulation form with normal-sized key-knob, for the reason that the physical habits of key sending must be based on muscular practice. If one becomes accustomed to using an abnormally large or wrongly adjusted key, he will be handicapped in the later use of the standard instrument. The key, buzzer and battery should be connected together, as shown in Fig. 4, when the buzzer will sound continuously so long as the key-knob is depressed and the circuit closed. The key should be screwed directly to the practice table, well toward the right and rear, so that the operator's elbow can rest on the table surface while he is sending. The distances must be selected so that the key-knob is within easy reach, and yet not so close that operation is cramped. It is important to fasten the key directly to the table top, without any sub-base which tends to lift the knob too high above the surface. A very good plan for the new student to follow is to call at some local telegraph office and see the actual arrangement of keys there used. The operators and office managers are usually glad to explain the key arrangements and the best way of holding the knob for sending, though one should of course not ask such favors during the busy hours of the day.

Holding the Morse Key

Having mounted the key, the next thing to learn is how to hold it properly. There are variations in the "grip" from operator to operator, but the essentials are that the fingers should be arched into an approximate quarter circle and have their tips resting on top of the knob, the thumb should press gently but firmly on the side-rim of the knob, the wrist should be held up clear of the table surface and the elbow should rest upon it. The key should be pressed shut, never "tapped," and should open easily through the action of its own spring. The muscular impulse which closes the circuit must be gentle and firm, coming from the full arm. The wrist must not be stiff, nor yet must the lower arm muscles be used (through the wrist-joint) for the entire key manipulation. The proper distribution of muscular effort, and the correct use of the inertia of the fore-arm for rapid sending can only come from long practice; nevertheless, it is important to bear the above suggestions in mind at first, so as to form correct habits at the beginning of work.

Practicing Dots and Dashes

The first actual sending should consist of dots only. Make dots slowly, being careful to keep the interval between each pair of them exactly the same length as the dots themselves. As you find that you can make them perfectly, increase the number until you can send three or five per second without difficulty. Then take up dashes, slowly at first, increasing the speed till about one per second can be made perfectly. Remember that when sending dashes the space between each pair of signals must be only one third as long as the dash itself; this is the only difference between the rapid series of dashes and the slow series of dots. Next take up alternate dots and dashes, being careful to keep the spaces between the signals correct. Although speeds corresponding to those suggested must be attained through practice, never sacrifice accuracy for the sake of sending fast. Reliable, smooth and carefully-spaced transmission is the first requisite; speed follows as a matter of course.

When the student overcomes the difficulty of changing from dots to dashes by preliminary practice of the sort just described, he may begin sending Morse letters and words. The first two groups of letters (Fig. 2) and the practice words given here will afford ample work for some time. As soon as the first six letters are thoroughly learned, the third group may be used. New practice words and sentences may now be made up easily, since the fourteen letters using three or fewer signals permit spelling a large number of words. At this stage of practice it is advisable to commence reading by sound. Consequently an automatic sender or a companion student is needed. In the next article, circuits for a buzzer telegraph line, over which messages may be sent between two houses or rooms, will be described. Meanwhile learn and practice the code, and remember that care and accuracy are the two essentials for which to strive.

(*To be continued*)

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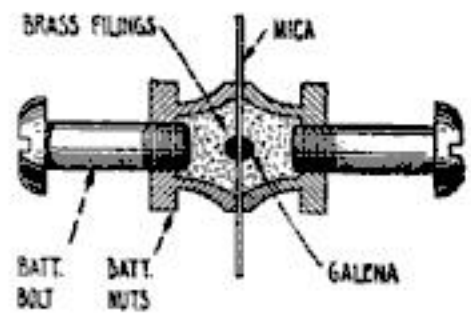

Filings in nuts between the bolt ends

While waiting for the glue to harden, remove the two thumb-nuts from the binding posts on any ordinary dry battery. Glue these nuts, top outwards, to each side of the mica so that the galena will be between the burrs but touching neither of them. After the glue is dry the projecting mica may be cut away.

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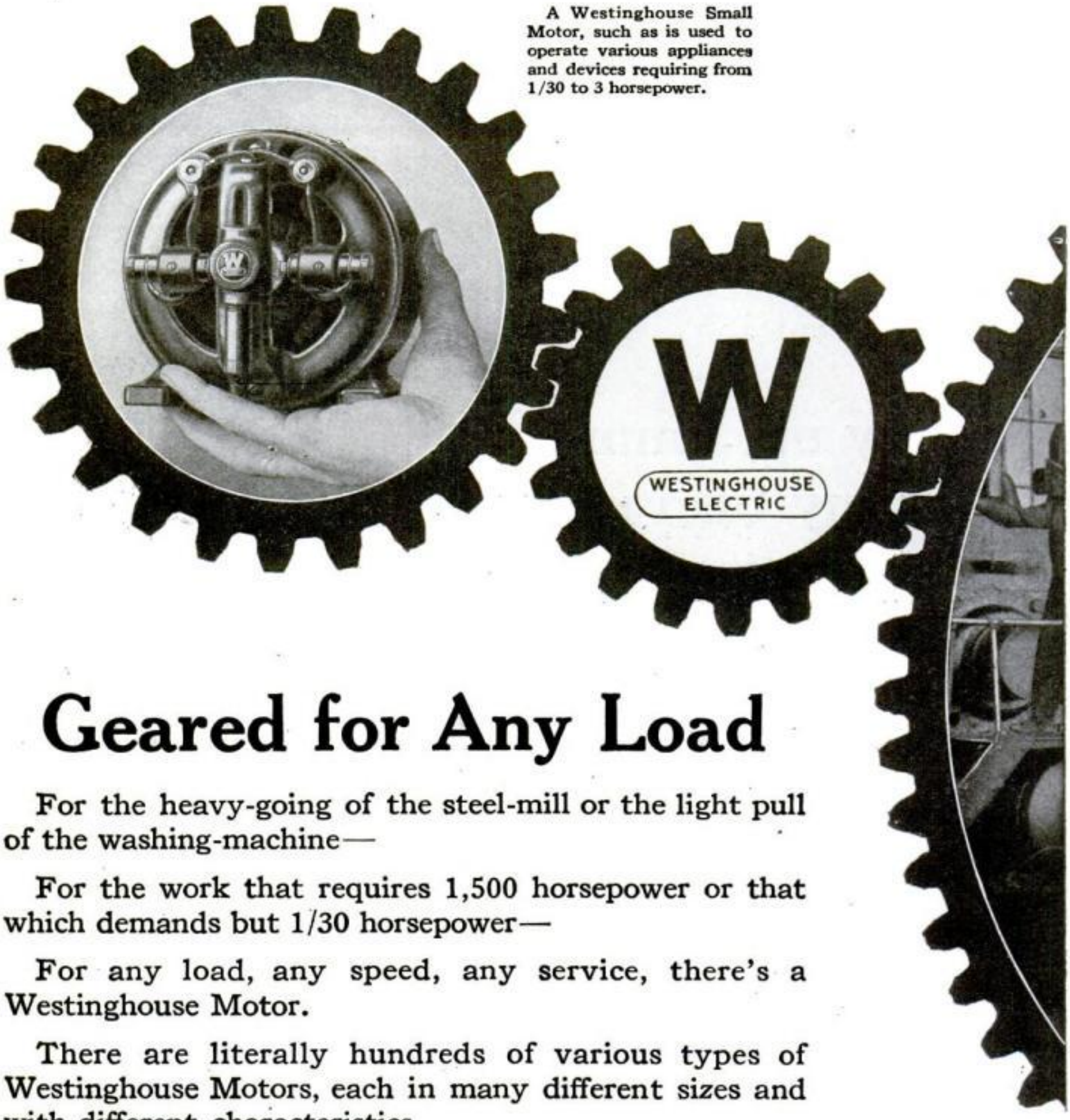

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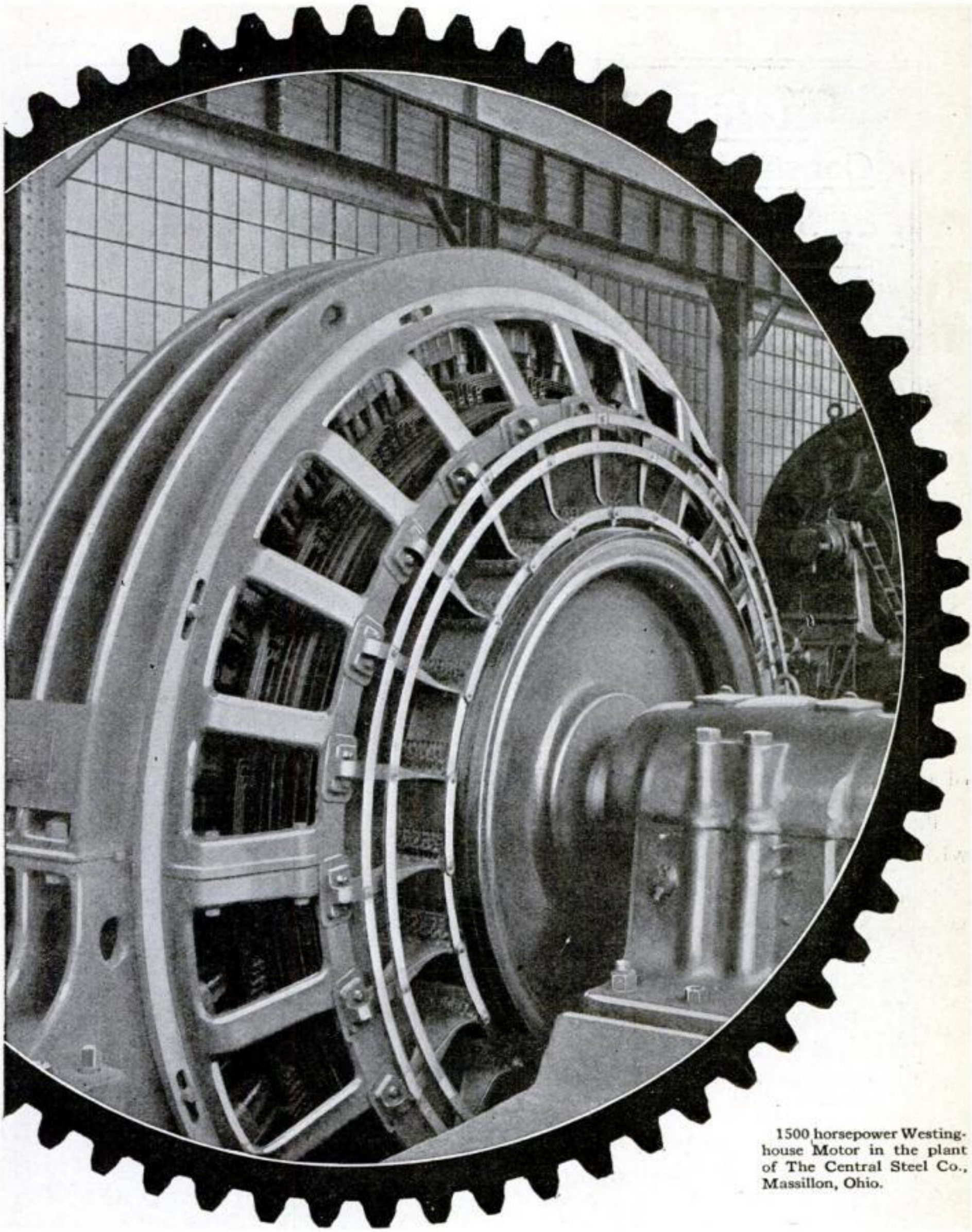

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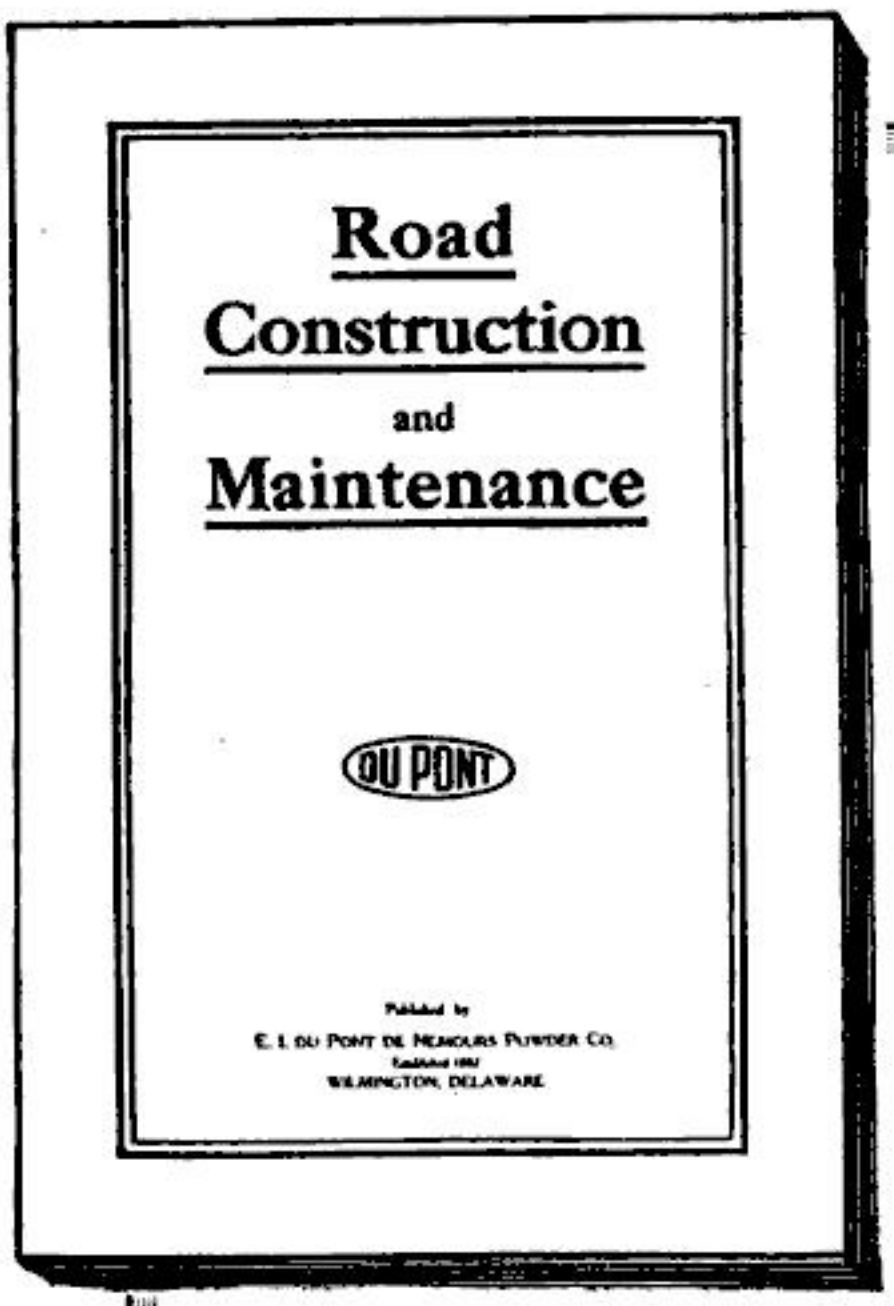

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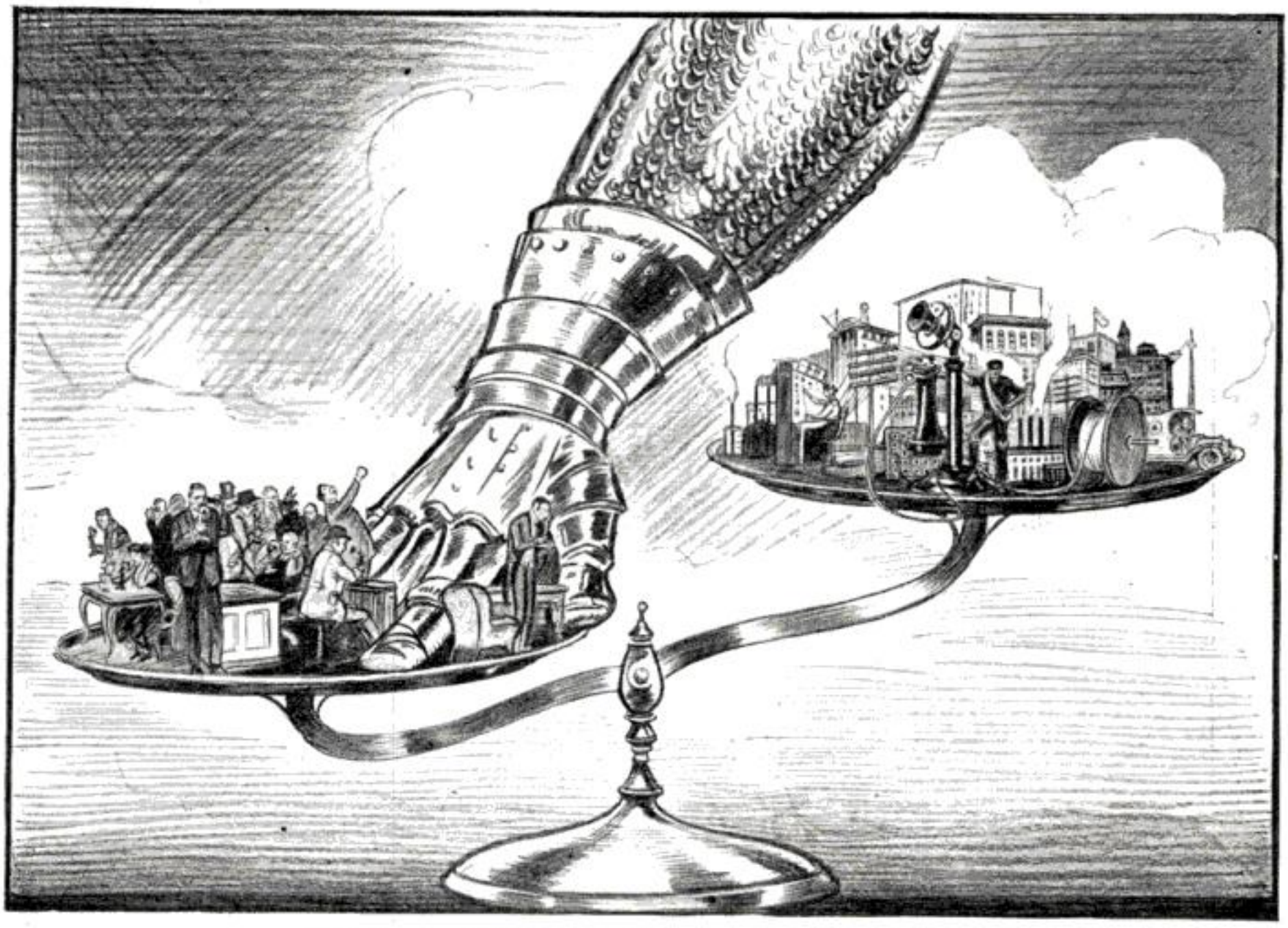

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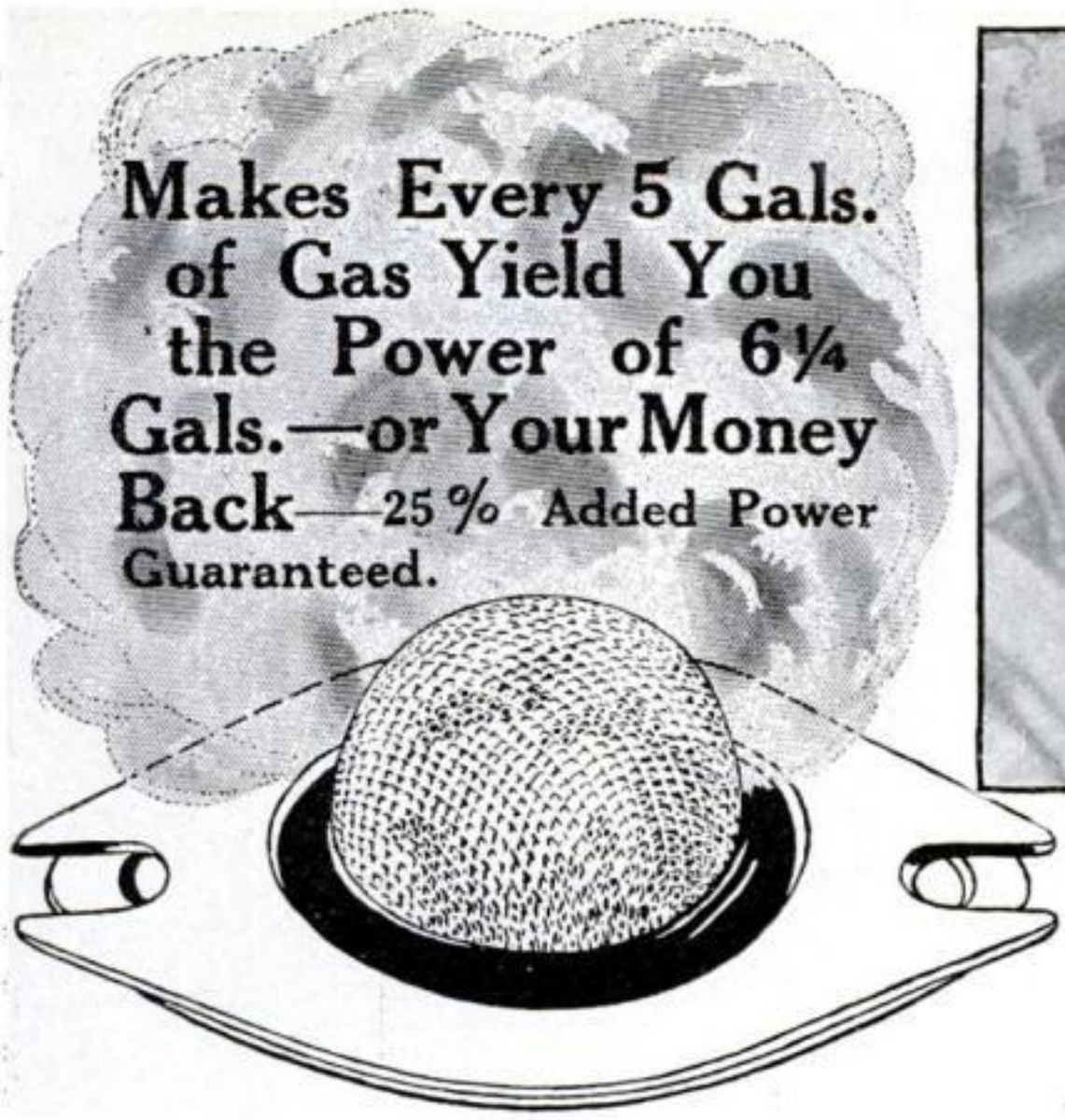

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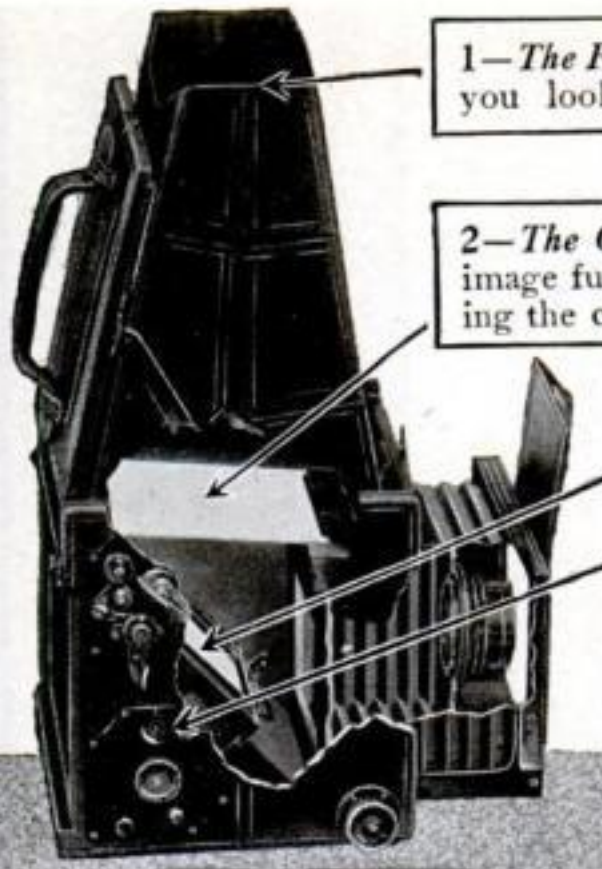

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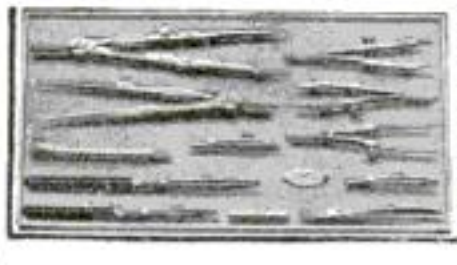

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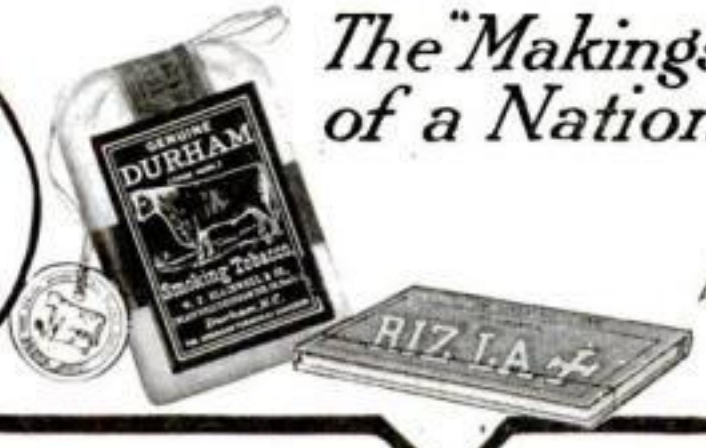

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